December 1983
Vol. 9, No. 12
$2.95

Programming Techniques

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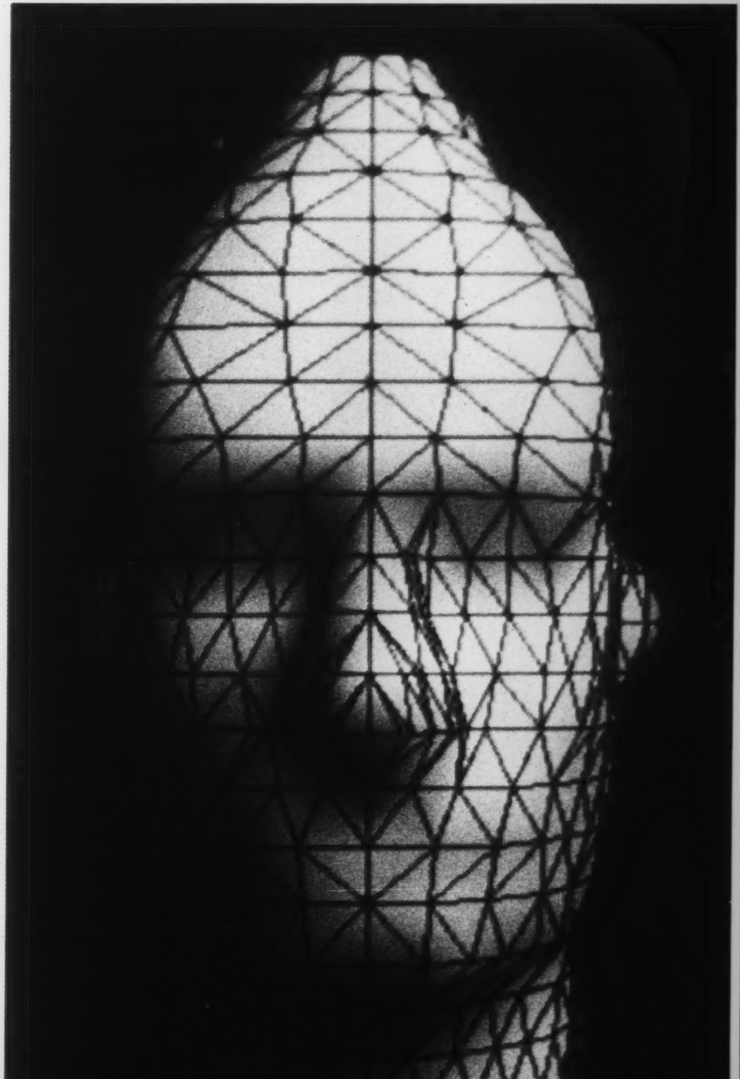

In-Depth Evaluations:

- Kaypro 10
- Casio FX-700P
- Quadlink
- Koalapad
- Pixy Plotter
- Percom TI Disk Drive
- Apple Mechanic
- The Tool
- DiversiDOS
- XEdit
- Memory / Shift
- MULE
- Witness and Planetfall
- Games for TS 1000
- Arcademic Learning Series
- Spacediscs
- Controller Update

High Precision Functions in Basic

CBasic Clinic

Basic Debugging

Input Line Editor

Plotting Tutorial

Preventive Maintenance Primer

WHILE OTHER COMPUTER
COMPANIES ARE BUSY
SETTING NEW PRICES,
SPECTRAVIDEO IS BUSY
SETTING NEW STANDARDS.

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MSX™ and LOGO™: Two
Spectravideo is
in Personal

While price wars and confusion reign all around us, Spectravideo goes about its business, setting standards by which all other personal computers will soon be judged. MSX and LOGO are the two latest examples of how Spectravideo is rocking–and reshaping –the personal computer industry.

MSX AND LOGO.

It is now history that, on June 15 1983, Spectravideo, Inc. joined with most of Japan's largest electronics firms to launch MSX: The most far-reaching personal computer standard in history. MSX is the name given to a specific hardware/software configuration that makes product interchangeability possible. While Spectravideo is proud to participate in MSX, we are even prouder of this fact: It was our own SV-318 computer that was used as a prototype for the MSX design! There are two important aspects to this.

First, all future MSX hardware–i.e. computers, peripherals, appliances–will be based on several key design elements of the SV-318. What does this mean to you, the consumer? A great deal, because when you buy an SV-318, you will not only be able to use all of Spectravideo's own software and hardware–you'll also be able to take advantage of all the remarkable new equipment that will be coming from other MSX participants.

In addition, the software aspect of MSX was largely inspired by the software built into the SV-318. From the outset, Spectravideo offered built-in Microsoft BASIC as its resident interpreter. Now, Microsoft

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also makes a LOGO program compatible with the SV-318. It was Spectravideo's Microsoft BASIC/LOGO that helped to make MSX possible.

Another standard that Spectravideo can take credit for is the built-in Joystick/Cursor Control. Built right into the SV console, this control is always at fingertips and is much easier and faster to use than external joysticks or conventional editing controls. Certain engineering elements that helped to make this built-in control possible have also been incorporated into MSX.

OTHER STANDARDS OF EXCELLENCE.

While these are the computer standardizations that Spectravideo helped to initiate, they by no means represent the whole SV-318 story. This remarkable computer has also established many standards of excellence that other personal computers now aspire to:

- ***Built-In Super Extended Microsoft BASIC***–*Makes the SV-318 the first truly programmable affordable computer!*
- ***Extraordinary Memory***–*32K ROM expandable to 96K, and 32K RAM expandable (via bank switching)to an amazing 256K.*
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- ***Advanced Graphics Capabilities***–*The SV-318 offers 16 colors in high resolution, and more importantly, 32 programmable sprites that allow tremendous control of movable screen objects.*
- ***Many other fine features***–*Such as Z80A Microprocessor with fast (3.6) internal clock, top-loading cartridge slot, 10 user-programmable special function keys, 3 sound channels (8 octaves per channel!), low profile and attractive styling.*

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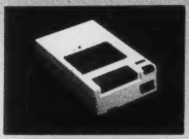
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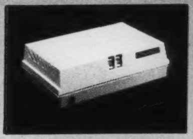
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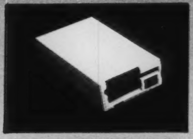
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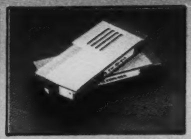
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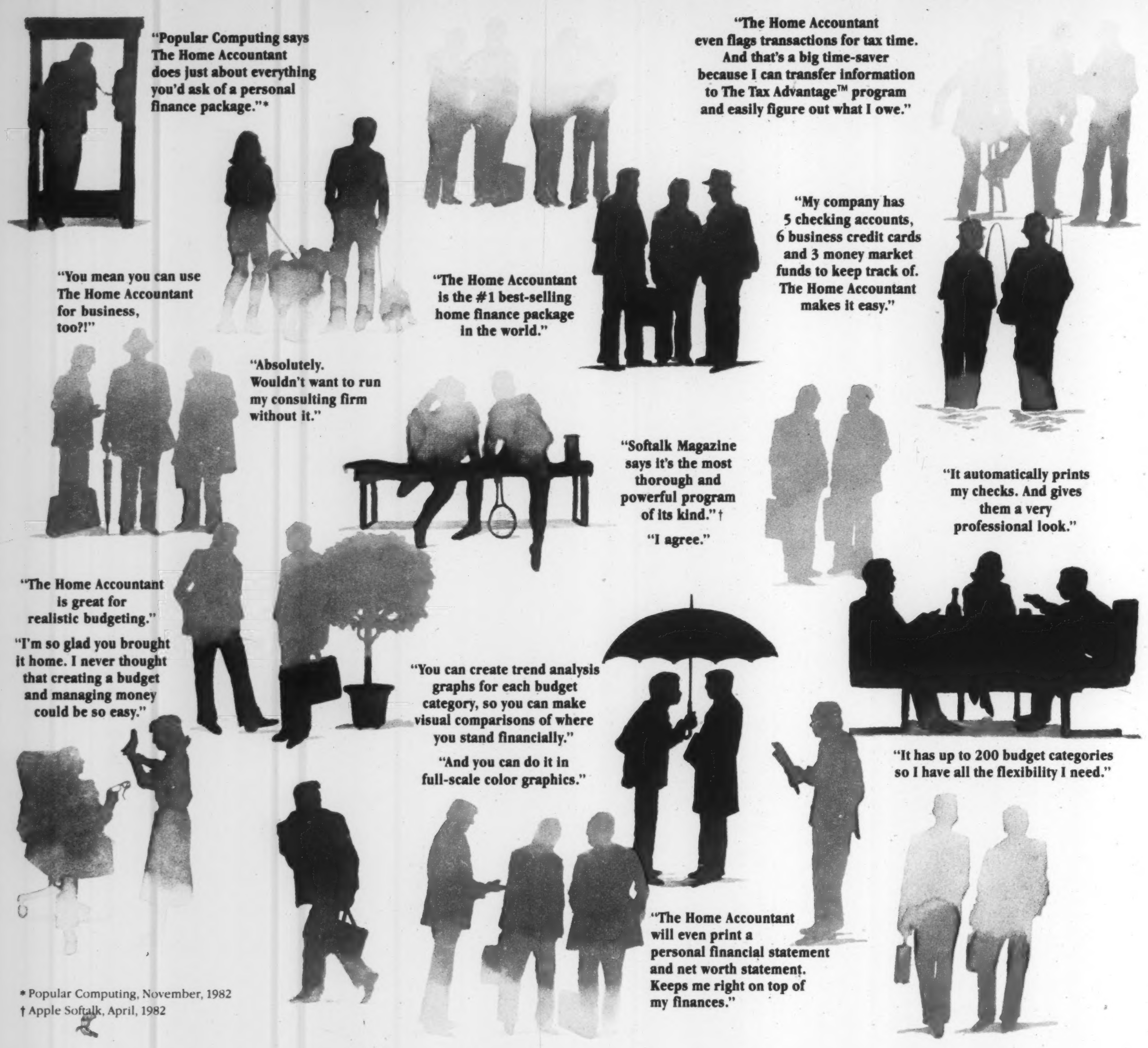

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* Popular Computing, November, 1982

† Apple Softalk, April, 1982

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Creative Computing (ISSN 0 097-8140) is published monthly by Ahl Computing, Inc., a subsidiary of Ziff-Davis Publishing Company. David Ahl, President; Elizabeth B. Staples, Vice President; Selwyn Taubman, Treasurer; Bertram A. Abrams, Secretary. P.O. Box 789-M Morristown, N.J. 07960. Second Class Postage paid at Los Angeles, CA 90052 and additional mailing offices.

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Editorial offices located at 39 East Hanover Ave., Morris Plains, NJ 07950. Phone (201) 540-0445.
Domestic Subscriptions: 12 issues $24.97; 24 issues $43.97; 36 issues $57.97.
POSTMASTER: send address changes to Creative Computing, P.O. Box 5214, Boulder, CO 80321. Call 800-631-8112 toll-free (in New Jersey call 201-540-0445) to order a subscription.

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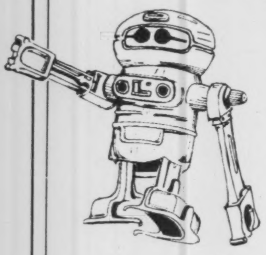

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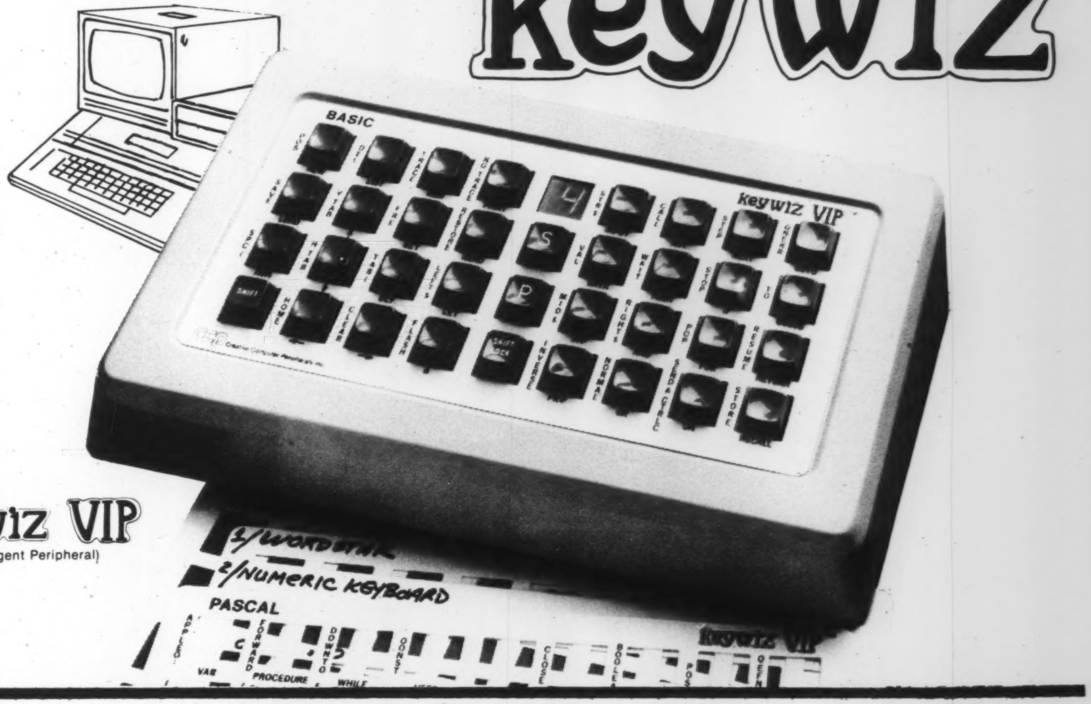

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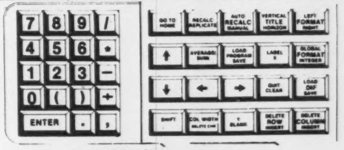

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GLOBAL FORMAT INTEGER
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BLANK
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DELETE COLUMN INSERT

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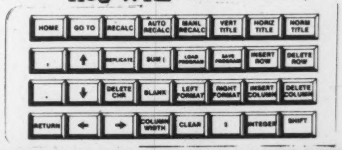

HOME
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SUM (
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SAVE PROGRAM
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DELETE ROW
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DELETE CHR
BLANK
LEFT FORMAT
RIGHT FORMAT
INSERT COLUMN
DELETE COLUMN
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Street Price Index

The Creative Computing Street Price Index is an on-going monitor of the average price levels of selected computers, peripherals, video games and related accessories in the real-world marketplace. The list price is the price set by the manufacturer for the product when it was first announced, and is not necessarily the current manufacturer list price.

As time goes on, this Index will be presented in graphical form, but until there are six or seven data points, a graph would be of little value.

This Index is not intended to be a purchasing guide. Frequently, the lowest price for a computer will be offered by a vendor who is going out of business or closing out that particular item. Unless you are convinced you will never need service or are skillful enough to repair an unhealthy computer yourself, you would probably not want to buy a machine from such an outlet.

Furthermore, most of our price monitoring is done in major metropolitan areas on the two coasts. Prices outside of large cities and in the central part of the country are usually higher.

	Orig List	Oct. 1983	.......Monthly.......			
Computer	**Price**	**High**	**Low**	**Average**	**Month Ago**	**Year Ago**
Apple IIe (64K, 40-col)	1395	1395	1149	1260	1260	n/a
Atari 400, 16K	559	259	69(1)	164	164	352
Atari 800, 48K	999	549	199(1)	374	412	863
Atari 1200, 64K	899	679	249(1)	464	514	n/a
Commodore Vic-20	297	149	69	109	109	274
Commodore 64	599	399	179(1)	289	294	n/a
Osborne 1, 64K	1795	1795	975	1390	1440	1895
Radio Shack:						
Color Comp, 16K	399	199	199	199	199	399
Model 4, 64K	999	999	799	899	999	n/a
TI 99/4A, 16K	635	269	84(1)	167	167	299
Timex 1000, 2K	99	65	29	43	43	149
Average home computer (up to 16K)	398	208	88	143	145	295
Line Printer						
Epson FX-80	699	695	535	615	615	n/a
Epson MX-80FT	745	505	395	450	450	567
NEC PC-8023A	795	499	379	439	449	599
Okidata 82A	799	459	380	420	420	549
Okidata 92	699	599	449	524	544	n/a
Star Gemini 10	449	399	279	350	357	n/a
Average 80-col dot matrix printer	697	526	409	467	470	572
Video Games						
Atari 2600	199	99	55(1)	77	84	149
Atari 5200	269	200	148	174	178	n/a
Colecovision	199	189	135	162	162	n/a
Intellivision II	199	150	79(1)	115	115	189
Average video game	216	145	109	127	127	169
Dynamic Memory Chips (200 ns, quantity 8)					...Lowest..	
16K x 1 bit (4116)	...	1.95	1.50	1.73	1.50	1.56
64K x 1 bit (4164)	...	7.49	5.75	6.62	5.95	n/a

(1) Includes a manufacturer rebate or equivalent

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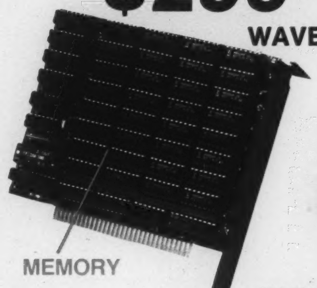

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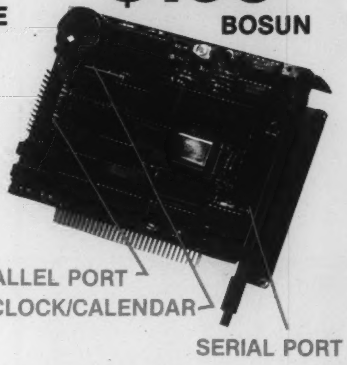

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The Kaypro 10

More Than Just a Big Screen Portable

Max A. Lebow

It used to be that a good hard disk drive would cost you more than Kaypro currently charges for its new Kaypro 10. The Kaypro 10 works like the earlier Kaypro II and Kaypro 4, the portable computers that made Kaypro's reputation. The main difference in the Kaypro 10 is the gigantic 10Mb disk drive.

Although hard disk technology has meant complicated procedures for turning the computer on and off, the Kaypro 10 has eliminated them. When you turn on the Kaypro 10 it automatically logs you onto the hard disk; before power off, you must remember to type SAFETY.

creative computing

HARDWARE PROFILE

Product: Kaypro 10
Type: Portable Computer
CPU: Z-80
RAM (min/max): 64K
ROM: 2K
Type of keyboard: Full-featured
72 keys, 20 programmable keys,
14 numeric keypad
Text resolution: 80 x 25
Graphics resolution: 160 x 100 pixels
Number of colors: N/A
Sound capability: N/A
Ports: 1 Centronics, 2 RS-232C
light pen connection
Dimensions: 8" x 18" x 15 1/2"
Documentation: Good
Price: $2795
Summary: Good value for the money.
A solid product.
Manufacturer:
Kaypro
533 Stevens Ave.
Solana Beach, CA 92075

Max A. Lebow, Microcomputer Consultant, 2121 Locust, Philadelphia, PA 19103.

Although Kaypro computers are small enough to be portable, people who buy them are not necessarily interested in the portability. With the Kaypro 10, the relative vulnerability of the hard disk makes rough handling of the machine undesirable.

File Capacity And Data Handling

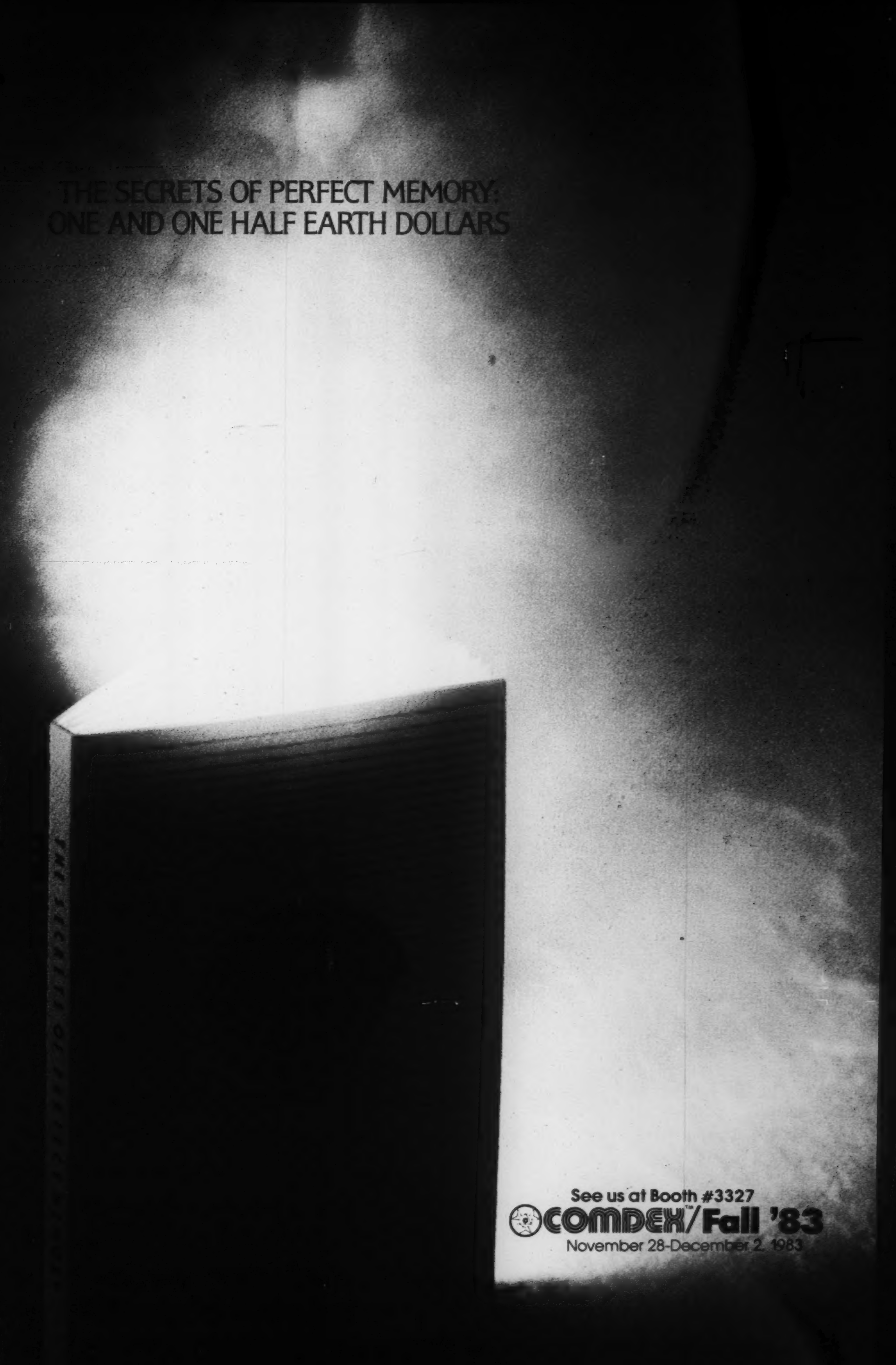
Think about ten telephone books each from a town of 25,000 people. That is ten megabytes of information. One way of dealing with this much storage is to divide it up into environments. The word processing environment can have all the word processing utilities and the text files. The programming environment can have the languages and the programming tools. A database environment might have the database, associated files, report generation utilities, and some word processing.

When you power up the Kaypro 10, the first thing you see after the power on message is the CP/M A> prompt. The A drive and the B drive referred to in CP/M are both resident on the hard disk. Drive C is the 400K floppy drive.

The CP/M operating system allows you to set up different environments by assigning each environment a user number. When you are logged on as that user (no password required), the files in that environment are shown in the directory. All other files are available, but you are not reminded of that fact. The latest release of CP/M contains utilities for transferring files across user numbers, and searching for files across user numbers.

Racing Stripes

One feature that identifies all Kaypro portables is the sturdy metal case. This makes Kaypro heavier than many other portables: 31 pounds for the Kaypro 10, slightly less for the earlier models. The paint job enhances the overall appearance of the case, with the characteristic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multiple "racing stripe" carried along the sides.

In use, the Kaypro 10 sits up on a built-in strut. To pack it up for carrying, it uses the keyboard housing for a base. In the position, the carrying handle on the back of the machine faces upward, ready to carry. The main computer attaches to the keyboard at the sides.

Connecting The Keyboard, Printer, And Modem

The keyboard is connected to the computer by a phone cord. This offers several advantages. First, connecting and disconnecting the keyboard is easy. Second, if the cord is damaged, it is easy to find another one. Third, the cord itself is relatively inexpensive, retailing for seven or eight dollars. If you are in a hurry packing up, you don't have to disconnect the keyboard, because even with the keyboard attached, the case will still close.

One rock or suitcase corner in the wrong place could damage the connectors.

Two printer connectors, one serial and one Centronics parallel, are provided. Earlier Kaypros have only the Centronics parallel plug. The modem or other device attaches via an RS-232 connector. Both connectors can be configured under the CP/M software from a menu-driven program called CONFIG. The RS-232 port is set up to handle the $100 Signalman modem without modification to either hardware or software. The Centronics parallel port is set up so that many popular printers can be plugged in and run with no modification.

If you are going to be taking the Kaypro on trips, bear in mind that the port connectors are not protected. Although the connectors themselves are quite sturdy, one rock or suitcase corner in the wrong place could damage the connectors. Other portables, the Telcon Zorba, for example, come with at least some form of protection for the connectors.

A modular plug for a light pen is installed in the back of the Kaypro 10, adjacent to the modular plug for the keyboard cable.

Keyboard Programming Pros And Cons

Most computer keyboards come with more keys than anyone who grew up with a typewriter can comfortably use. Still it is convenient that the cursor control keys and the numerical keypad are programmable. They are not fully programmable, but they can return any designated byte value you choose. This means one programmed key can be the same as holding down the control key and another key.

One writer I know has programmed the numeric keypad on his Kaypro to execute several of the frequently used control key commands found in *Perfect Writer* (another software package that comes with the Kaypro). The keys are personalized using the CONFIG program which is part of the CP/M system supplied with the computer. This is a menu-driven program that depicts the keys to be programmed on the screen and asks the user to supply the hexadecimal value of the byte to be returned when that key is pressed. The hexadecimal values for the ASCII characters and the control codes are available in most programming books, printer instruction manuals, and in appendix M of the MBasic manual supplied with the Kaypro 10.

It is generally agreed that a keyboard should make some sound when you press a key. This gives you some feedback; it tells you the keystroke has been duly registered. This little key click saves you the trouble of looking at the screen all the time to make sure you have not dropped a letter. This is more important in offices than for home users. In fact, home users may want to work near people—children, parents, spouses, in-laws—for whom the key click may be very irritating.

Although the key click on Kaypro keyboards sounds like an expiring cricket, fortunately it is software selectable. You can turn it off if your spouse asks you to. Either an OUT 5, 8 command line issued from MBasic or a command file created from S-Basic (both of which come with the Kaypro), will turn off the click.

The Big Screen

Big screen medium-resolution monochrome graphics (100 by 160 pixels) are available on the Kaypro 10, unlike the earlier Kaypro II and 4. Graphics are accessible from MBasic. Special extensions to S-Basic and sample subroutines in S-Basic are included with the Kaypro 10 to make it easier for programmers to develop graphics applications. (See sidebar). The hardware and software that drive the Kaypro 10 screen support blinking text, reduced intensity, inverse video, and cursor on/off.

Two graphics characters, a solid block and a patterned block, allow some "make-do" graphics on the Kaypro II and 4. Some of the games that come with the Kaypro use cleverly arranged letters and numbers to form graphic-like patterns for games. Aliens, for example, plays like Space Invaders.

Higher resolution color graphics boards are available for the Kaypro II and 4 as a retrofit. I have seen a wire wrap version of one of these running on a monochrome monitor, and it looked like about 256 by 512 pixels. Frankly, if you want fast, spectacular graphics, pick another machine.

One of the biggest issues among users of portables is screen size and legibility. Early portables designed for news reporting often had tiny screens that could not be read for long without eyestrain. This tradition was carried over to the Osborne 1, which has a 5″ diagonal screen, displaying about 50 characters per line. The Kaypro has a 9″ screen and fits 80 characters on a line. The Osborne Executive has a 7″ screen.

One might be tempted to say that Andy Kay, the inventor of the Kaypro, made his screen bigger when he learned about user resistance to the Osborne screen. However, according to Peter McWilliams, who wrote *Personal Computer Book,* Kay had been planning the Kaypro—as a portable engineering tool—for months before the Osborne came out.

What you see on the screen are green, upper- and lowercase letters. Letters are drawn from the character generation ROM and are a maximum of five dots wide by seven dots high. Letters that normally extend below the line, actually extend below the line when you see them on the screen. Although in earlier Kaypros these descenders tended not to be as tall as the letters that did not descend below the line—for example, the lowercase m was taller than the lowercase g. This curiosity has been remedied in the Kaypro 10.

Math buffs will be happy to know that a Greek character set is accessible by sending an ESC-G from the keyboard or PRINT CHR$(27); CHR$(71) from Basic. Lowercase letters are then displayed in Greek. Sending ESC-A or PRINT CHR$(27); CHR$(65) restores the normal lowercase display.

If you want fast, spectacular graphics, pick another machine.

Software, Software, Software

The software collection that comes with the Kaypro 10 starts with the same

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word processing, spreadsheet, file management, and utility software offered with previous Kaypro models. *Perfect Writer,* the word processor, was reviewed in the June 1983 *Creative Computing.* Running *Perfect Writer* on a 10Mb machine like the Kaypro 10 means you can have a larger swap file (252K as compared with 64K for the Kaypro II version of *Perfect Writer*). Because *Perfect Writer* views the swap file as an extension of RAM, having a larger one means that you can assemble a larger and more complicated book—more headings and subheadings, more footnotes and cross references.

The greater disk space also alleviates concern about where to put the formatted files *Perfect Writer* creates. These are always at least as long as the original text file. A *WordStar* software bundle has been offered since the middle of June. It does not include *MailMerge,* but does include most of the other packages in the standard Kaypro software bundle.

Two spelling check programs come with the Kaypro 10, *Perfect Speller* and *The Word Plus.* Both contain large dictionaries. The larger storage capacity of the Kaypro 10 means that both of these programs can be accessed without changing disks.

The file manager is *Perfect Filer.* This is a menu-driven system designed to lead the user through the entire database process. Each aspect is covered, via menus: setting up the structure of the database, entering data, selecting data for reporting, and structuring reports for output on the CRT and the printer. Some users have complained the *Perfect Filer* is slow and that the menu structure is cumbersome. It is, however, a capable file manager. Users can specify a wide range of reports based on matching and limiting criteria. However, it is designed for smaller databases (up to about 1200 records), and the extra storage capability of the Kaypro 10 is, in a sense, wasted on it.

Two spreadsheets are included with the Kaypro 10, *Perfect Calc* and *Profit Plan. Profit Plan* is a first generation spreadsheet. Commands are entered by number. Numbers and their corresponding commands are listed along the righthand side of the screen. This feature, although friendly—I was using *Profit Plan* minutes after loading it—is quite cumbersome.

Perfect Calc, on the other hand, lets you move a cursor around the spreadsheet. Further, the program attempts to anticipate what you want done based on the content of the data you enter. For example, entries beginning with a decimal digit, a minus sign, or a decimal point are automatically classified as numerical; entries beginning with letters and symbols are assumed to be labels; entries beginning with an equal sign are assumed to be formulas.

Perfect Calc also has a respectable collection of built-in statistical and trigonometric functions, although not as many as some spreadsheets. The extra storage of the Kaypro 10 allows more associated spreadsheets and overlays to be linked together on line. Calculation takes place more quickly because disk access is quicker. (Part of the speedup is attributable to the fact that the Kaypro 10 uses a 4MHz Z80A; earlier Kaypros ran with slower clock speed.)

Languages And Systems Software

In addition to the applications programs, the Kaypro 10 comes with Microsoft's MBasic and a compiler Basic called S-Basic from Topaz Programming. CP/M 2.2 is also included.

For those who struggled with Radio Shack's Level I and Level II Basic languages, the best news about the MBasic that comes with the Kaypro is that it allows variable names longer than two characters and a type identifier. Other handy features for programmers include a command for renumbering program lines or ranges of lines, a function definition facility, and random access disk commands.

> ***The best news about the MBasic that comes with the Kaypro is that it allows variable names longer than two characters and a type identifier.***

CP/M 2.2 for the Kaypro 10 comes with the required hard disk BIOS, and in fact the system initializes to user 0 on the hard disk on power up. A directory management facility, D, helps users find files by alphabetizing directory display, displaying information on file attributes without using the STAT command, for example.

To accommodate the serial printer port, the CONFIG program has been expanded to allow the user to specify which printer port will be used with a given word processing program. Another accommodation for the additional serial port is the inclusion in the system software of two BAUD programs. BAUDM sets the baud rate on the modem port, and BAUDP sets the baud rate on the printer port.

Terminal emulation software—the Kaypro 10 can emulate an ADM3 terminal—is provided with all the other software. This program, TERM, does enough to get you started on the Source or Compuserve, but it does not support file transfers. Also, under TERM the Kaypro locks up when you go into the terminal communications mode, if no modem is attached, requiring that the system be cold booted. This admittedly minor inconvenience contrasts with the automatic warm boot that occurs when trying to print using the PIP LST:= command. The standard CP/M utilities, DDT and ASM, are included.

A very important command is included in the Kaypro 10 system software. SAFETY moves the read/write heads on the hard disk to the safe landing zone on the disk. This must be done before turning the power off or the surface of the hard disk may be damaged. The SAFETY command is invoked from the command mode in CP/M.

Documentation

Three substantial paperbound books, one each for *Perfect Writer/Speller, Perfect Calc,* and *Perfect Filer* lead you through these software packages. Pocket guides to these programs also arrive with the computer. Three larger paperbound books document MBasic, S-Basic and, CP/M.

A 100-page ring binder introduces the user to the Kaypro 10. This volume replaces the smaller spiral-bound book that introduced users to the Kaypro II and 4. This volume also introduces the major software programs. Pocket guides for *The Word* and MBasic, and the documentation for *Profit Plan* round out the documentation set.

Documentation for MBasic and CP/M seems to have been collected and photocopied from various documents and listed from disk files and photocopied, rather than typeset. The CP/M documentation is in separate sections that appear to have been self contained at one time. One of the many introductions to CP/M now in the book stores would be a wise investment for anyone new to both CP/M and the Kaypro.

In Summary

The overriding impression of this machine is of quick and inexhaustible storage and retrieval capacity. The screen will do, and the keyboard is rugged and reliable. About the only serious limitation is the 8-bit microprocessor. For the near term, there is still more software for 8-bit machines than for the emerging 16-bit machines.

Color graphics would be nice if this were a game machine, but it is not a game machine. It is designed for business, and even the portability, although attractive, is less important than the unbeatable cost/performance ratio.

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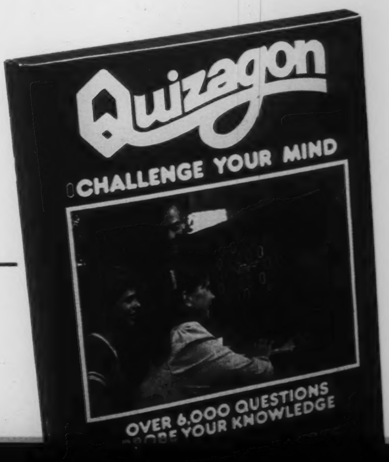
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A Graphics Interface for Perfect Calc

For some time now, it has been considered desirable to be able to produce graphs from data on a spreadsheet. Products such as Lotus *1,2,3* provide this capability. The alternative is copying numbers from the spreadsheet on paper then entering the numbers into the graphics display program.

Perfect Calc, the spreadsheet program provided in the Kaypro software bundle, provides a limited bar chart capability within the columns of the spreadsheet itself, allowing the user to form horizontal bars of asterisks in the designated column.

Less than a month after the Kaypro 10 was on the market, Jonathan Sackner, a beginning medical student and computer consultant in Philadelphia, demonstrated exclusively for *Creative Computing* a graphics program using the 100 by 160 pixel graphics capability of the Kaypro 10 CRT screen. The program draws bar charts from *Perfect Calc* data.

It works like this. You decide which row(s) or column(s) have the information you want to have graphed. This information, together with the appropriate row or column of labels, is written to a text file by *Perfect Calc.* The text file is then read by the graphics program and the graph is drawn. Scaling of the graph is done automatically, and both positive and negative numbers can be represented.

As of this writing, bar charts produced by Sackner's program can be hollow, filled-in, two dimensional, or three dimensional. The program also allows more than two rows or columns to be graphed. Labels, if available in the *Perfect Calc* file, are positioned and displayed automatically as well. Before it displays a graph, the program requests a title.

Enhancements to the program are under development. For example, more menus are planned to make the graphics program even easier to use.

Graphics Subroutines Included in S-Basic

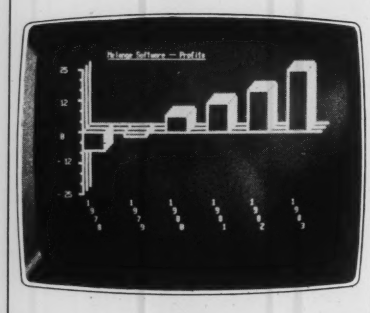
Table 1.

BAR: Produces a two- or three-dimensional bar on the screen. The lower lefthand corner point is specified by the user, as are the upper righthand corner point and the lefthand back corner point. The bar may be hollow or filled.

CIRCLE: User specifies the radius and the center point.

RECTANGLE: Lower left corner, height, and width are specified by the user to define the rectangle this subroutine displays.

SQUARE: Lower left corner and length of side are specified.



LINEON/LINEOFF: User specifies the end points of the line.

PIXON/PIXOFF: Position of pixel to be turned on or off is specified in X and Y coordinates.

POSITION: Positions the cursor at user-specified X and Y coordinates without disturbing pixels or text.

SET.ON/SET.OFF: Turns on or off the pixel at the current cursor location.

Listing 1. S-Basic Subroutines for the Kaypro 10.

```
PROCEDURE SET.ON (ATT=CHAR)
        PRINT CHR(27); 'B'; ATT;
END

PROCEDURE SET.OFF (ATT=CHAR)
        PRINT CHR(27); 'C'; ATT;
END

PROCEDURE POSITION (VERT, HORZ = CHAR)
        PRINT CHR(27); '=' ; VERT+31; HORZ+31;
END

PROCEDURE PIXON (VERT1,HORZ1=CHAR)
        PRINT CHR(27);'*';(VERT1+31);(HORZ1+31);
END

PROCEDURE PIXOFF (VERT1,HORZ1=CHAR)
        PRINT CHR(27);' ';(VERT1+31);(HORZ1+31);
END

PROCEDURE LINEON (VERT1,HORZ1,VERT2,HORZ2=CHAR)
        PRINT CHR(27);'L';(VERT1+31); (HORZ1+31); (VERT2+31); (HORZ2+31);
END

PROCEDURE LINEOFF (VERT1,HORZ1,VERT2,HORZ2=CHAR)
        PRINT CHR(27);'D';(VERT1+31);(HORZ1+31);(VERT2+31);(HORZ2+31);
END

PROCEDURE CLEAR.SCREEN
        PRINT CHR(26)
END

FUNCTION SQRT(N=INTEGER) =INTEGER
        VAR ROOT1,ROOT2 = INTEGER

        ROOT1 = N
        ROOT2 = 1
        WHILE (ROOT1 > ROOT2) DO BEGIN
                ROOT1 = (ROOT1 + ROOT2)/2
                ROOT2 = N/ROOT1
        END
END = ROOT1

PROCEDURE CIRCLE (CENTER.Y, CENTER.X, RADIUS = INTEGER)
        VAR X, Y, OFFSET = INTEGER
        OFFSET = (RADIUS * 100) / 141

        PIXON CENTER.Y + RADIUS - 1, CENTER.X
        PIXON CENTER.Y - RADIUS + 1, CENTER.X

        FOR X = 1 TO OFFSET
                Y = SQRT(RADIUS^2 - X^2)

                PIXON CENTER.Y + Y , CENTER.X + X
                PIXON CENTER.Y + Y , CENTER.X - X
                PIXON CENTER.Y - Y , CENTER.X + X
                PIXON CENTER.Y - Y , CENTER.X - X
        NEXT
```

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CIRCLE 112 ON READER SERVICE CARD

Listing 1, continued.

```
        PIXON CENTER.Y, CENTER.X + RADIUS - 1
        PIXON CENTER.Y, CENTER.X - RADIUS + 1

        FOR Y = 1 TO OFFSET
                X = SQRT(RADIUS^2 - Y^2 )

                PIXON CENTER.Y + Y , CENTER.X + X
                PIXON CENTER.Y + Y , CENTER.X - X
                PIXON CENTER.Y - Y , CENTER.X + X
                PIXON CENTER.Y - Y , CENTER.X - X
        NEXT
END

PROCEDURE RECTANGLE (Y, X, HEIGHT, WIDTH = INTEGER)
        LINEON Y, X, Y + HEIGHT, X
        LINEON Y, X + WIDTH, Y + HEIGHT, X + WIDTH
        LINEON Y, X, Y, X + WIDTH
        LINEON Y + HEIGHT, X, Y + HEIGHT, X + WIDTH
END

PROCEDURE SQUARE (Y, X, SIDE = INTEGER)
        RECTANGLE Y, X, SIDE, SIDE
END

PROCEDURE BAR(REF.Y,REF.X,HEIGHT,WIDTH,DEPTH,INSIDE,VERT.P,HORZ.P=INTEGER)
        VAR I, TEMP, EMPTY, FULL, X, Y = INTEGER
        DIM INTEGER REF(2) CENTER(2) REAR(2)

        X = 1
        Y = 2
        FULL = 1
        EMPTY = 0

        REF(X) = REF.X
        REF(Y) = REF.Y
        CENTER(X) = REF.X + (WIDTH * HORZ.P)
        CENTER(Y) = REF.Y + (HEIGHT * VERT.P)
        REAR(X) = CENTER(X) + (DEPTH * HORZ.P)
        REAR(Y) = CENTER(Y) + (DEPTH * VERT.P)

        IF (INSIDE = EMPTY) THEN BEGIN
                FOR I = REF(X) TO CENTER(X) STEP HORZ.P
                        LINEOFF REF(Y), I, CENTER(Y), I
                NEXT I

                FOR I = 0 TO (WIDTH*HORZ.P) STEP HORZ.P
                        LINEOFF CENTER(Y), CENTER(X)-I, REAR(Y), (REAR(X)-I)
                NEXT I
                FOR I = 0 TO (HEIGHT*VERT.P) STEP VERT.P
                        LINEOFF CENTER(Y)-I, CENTER(X), (REAR(Y)-I), REAR(X)
                NEXT I

                LINEON REF(Y),REF(X),CENTER(Y),REF(X)
                LINEON REF(Y),REF(X),REF(Y),CENTER(X)
                LINEON CENTER(Y),CENTER(X),CENTER(Y),REF(X)
                LINEON CENTER(Y),CENTER(X),REF(Y),CENTER(X)

                LINEON CENTER(Y),CENTER(X),REAR(Y),REAR(X)

                LINEON REF(Y),CENTER(X),(REAR(Y) HEIGHT*VERT.P),REAR(X)
                LINEON CENTER(Y),REF(X),REAR(Y),(REAR(X)-WIDTH*HORZ.P)

                LINEON REAR(Y),REAR(X),(REAR(Y)-HEIGHT*VERT.P),REAR(X)
                LINEON REAR(Y),REAR(X),REAR(Y),(REAR(X)-WIDTH*HORZ.P)

        END

        IF (INSIDE = FULL) THEN BEGIN
                FOR I = REF(X) TO CENTER(X) STEP HORZ.P
                        LINEON REF(Y), I, CENTER(Y), I
                NEXT I

                FOR I = 0 TO (WIDTH*HORZ.P) STEP HORZ.P
                        LINEON CENTER(Y), CENTER(X)-I, REAR(Y),(REAR(X)-I)
                NEXT I
                FOR I = 0 TO (HEIGHT*VERT.P) STEP VERT.P
                        LINEON CENTER(Y)-I, CENTER(X), (REAR(Y)-I),REAR(X)
                NEXT I

                LINEOFF CENTER(Y),CENTER(X),CENTER(Y),REF(X)
                LINEOFF CENTER(Y),CENTER(X),REF(Y),CENTER(X)

                LINEOFF CENTER(Y),CENTER(X),REAR(Y),REAR(X)
        END
END
```

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Elementary, my dear Watson, from Spinnaker.

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CIRCLE 146 ON READER SERVICE CARD

Listing 2. Sample Graphics Program.

```
$INCLUDE GRAPHICS.BAS

VAR V1, H1, RADIUS = INTEGER
VAR V2, H2, HEIGHT, WIDTH = INTEGER
VAR V3, H3, LENGTH = INTEGER
VAR V4, H4, H, W, V.PERSPECTIVE, H.PERSPECTIVE, INTERIOR, DEPTH = INTEGER

PRINT CHR(26)

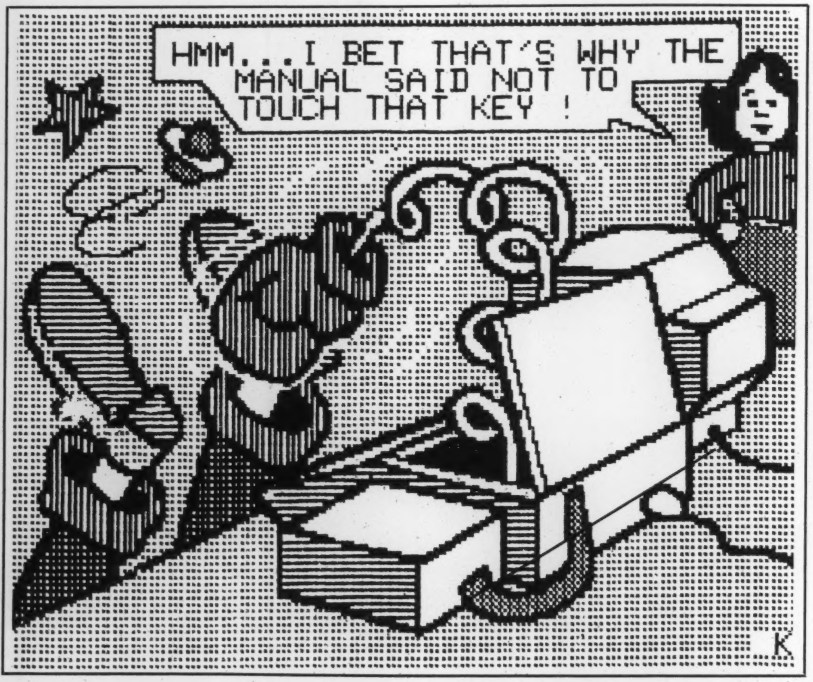
V1 = 15
H1 = 15
RADIUS = 10
CIRCLE V1, H1, RADIUS

V2 = 30
H2 = 10
HEIGHT = 20
WIDTH = 40
RECTANGLE V2, H2, HEIGHT, WIDTH

V3 = 60
H3 = 20
LENGTH = 30
SQUARE V3, H3, LENGTH

V4 = 80
H4 = 80
H = 50
W = 15
DEPTH = 8
V.PERSPECTIVE = -1
H.PERSPECTIVE = 1
INTERIOR = 0
BAR V4, H4, H, W, DEPTH, INTERIOR, V.PERSPECTIVE, H.PERSPECTIVE

V4 = 20
H4 = 130
H = 50
W = 10
DEPTH = 15
V.PERSPECTIVE = 1
H.PERSPECTIVE = 1
INTERIOR = 1
BAR V4, H4, H, W, DEPTH, INTERIOR, V.PERSPECTIVE, H.PERSPECTIVE
```


HMM...I BET THAT'S WHY THE MANUAL SAID NOT TO TOUCH THAT KEY !
K

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The Most Amazing Thing is out there somewhere. Finding it won't be easy. Luckily, your kids will have the help of old Uncle Smoke Bailey. Because they'll have to fly the B-liner, avoid dangerous Mire Crabs, and trade with aliens.

It takes skill, persistence and imagination to find The Most Amazing Thing. Because it's the most elusive thing in the whole wide galaxy. But that's what makes it so exciting.

It's Amazingly Educational!

Like all Spinnaker games, IN SEARCH OF THE MOST AMAZING THING has real educational value.

Your kids will sharpen their ability to estimate distances and quantities, and will become more aware of direction and time. They'll develop a knack for economic principles, and learn to solve problems through trial and error.

So if you're looking for exciting computer games that give your kids something to think about, just go IN SEARCH OF THE MOST AMAZING THING at your local retailer.* It's so much fun you'll probably be tempted to play it yourself.

IN SEARCH OF THE MOST AMAZING THING
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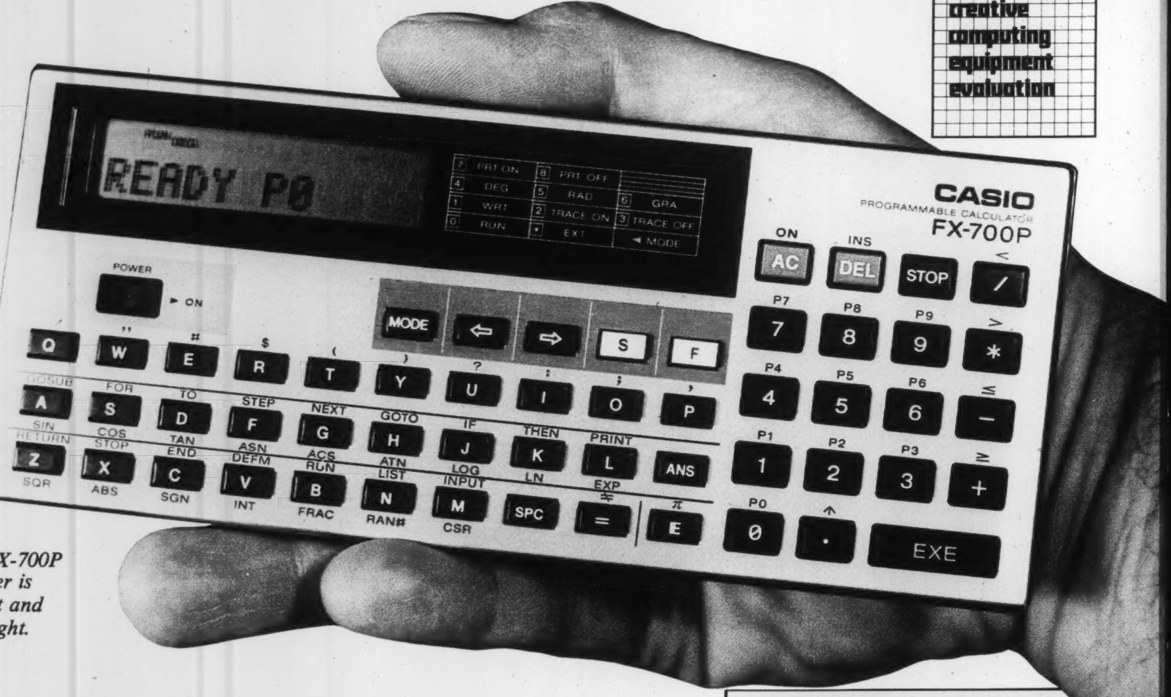


Casio FX-700P computer is compact and lightweight.

Casio FX-700P

David H. Ahl

Casio calls the FX-700P a programmable calculator, and so it is, but it also speaks a credible version of Basic. The machine is also sold by Radio Shack as the TRS-80 Pocket Computer, Model PC-4.

We tested the Casio version along with the FA-3 cassette interface, FP-12 thermal printer, and Multipac software package. All together, these components retail for about $200.

Compact and Portable

The computer is truly pocket-size, measuring just 6.5" x 2.8" x 0.4". Its weight is 4.2 ounces. The entire system with cassette interface and printer measures a diminutive 7" x 7" x 1.5". To this, you must add an external cassette recorder. We recommend the Panasonic RQ-8300 or Olympus C-100. Both are compact and were reliable in our tests.

All three components are battery-operated for true use-anywhere portability. Each of the units uses a different form of battery. The computer uses two lithium watch batteries with a life of about two years (or 300 hours of continuous use). The cassette interface uses two AA alkaline batteries, again with a stated life of two years. The thermal printer uses rechargeable NiCad batteries which, when fully charged, will print about 3000 lines. A battery charger, which will fully recharge the printer batteries in about 15 hours, is included.

All three components come with vinyl pouches, but there is none for the entire assembled system.

Also available for the system is a 4K external memory module and RS-232 interface.

FX-700P Calculator/Computer

The system uses a proprietary CMOS VLSI chip. Memory capacity is not stated in the normal way (1K, 4K, etc.). Instead, the manual states that the FX-700P has "26 memories (variables) which allow 1568 program steps. The maximum number of memories can be expanded to 222. For memory expansion, program steps are converted to memory using 8 steps per memory."

We have no idea how this translates to a comparative measure of memory.

creative computing
HARDWARE PROFILE

Product: Casio FX-700P computer (also Radio Shack PC-4)

Type: Pocket scientific calculator/computer

Specifications:
CMOS proprietary chip
1.5K program steps
Battery powered
6.5" x 2.8" x 0.4"
21 statements and commands, 19 functions.
Optional: cassette interface, printer, add-on-memory

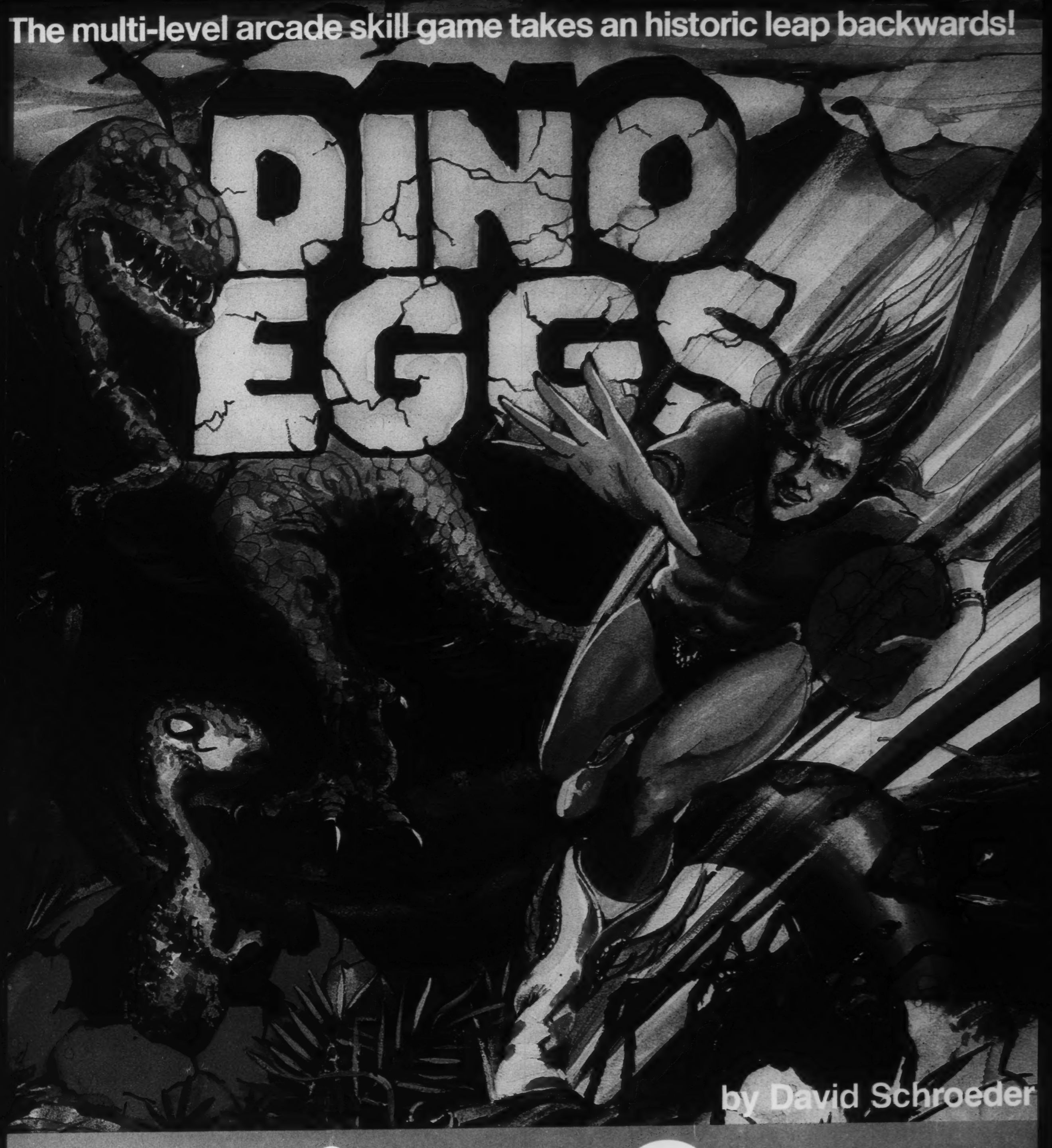
Ease of use: Slow program entry because of small keys; running stored programs very simple.

Documentation: Very complete, many examples, good book of programs.

Price:
Computer $69.95
Cassette interface $39.95
Thermal printer $79.95

Summary: Compact, lightweight pocket computer with good performance for the price.

Manufacturer:
Casio, Inc.
15 Gardner Rd.
Fairfield, NJ 07006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CIRCLE 290 ON READER SERVICE CARD

From experimentation, we deduced that a "program step" is equivalent to one character or keyword. For example, the line 30 PRINT N(I) takes eight steps—two for the number 30, one for the keyword PRINT, one each for the characters in N(I), and one for the line terminator. Thus, depending upon the type of programs you write, the FX-700P could be considered to have approximately 1.5 to 2K of storage for programs and data.

Yes, we mean programs. The FX-700P has the ability to store up to ten programs simultaneously. They are stored in areas P0 through P9 into which you log just as you would a large timesharing system. Actually, it is much easier with the FX-700P; you simply press the white S key followed by a number 0 to 9.

The bad news about the FX-700P is the display.

Interacting with the computer has many similarities to and many differences from a full-size personal computer. Naturally, the keyboard is much smaller on the FX-700P—minute you might say. The numeric keypad portion is at the right side and is laid out with normal size fingers in mind. The alphabetic keyboard follows the standard QWERTY pattern; however, the layout is rectangular and the keys are decidedly smaller than those on the numeric keypad. Thus, touch typing is totally out of the question, and even moderate speed entry is very difficult.

Each key has three meanings—the letter printed on it, a keyword or symbol printed over it in red, and a function printed under it in blue. To enter an alternative meaning, you must press the red S or blue F key prior to pressing the alpha key.

Two arrow keys move the cursor. All clear (AC) and delete (DEL) keys act as they do on a normal calculator. A STOP key halts program execution, while an execute (EXE) key acts as an all-purpose execute/return/enter key. A MODE key selects program write or run, printer on or off, program trace on or off, and angular measurement in degrees, radians, or gradients.

As with most modern calculators, if the FX-700P is not used for several minutes, the power is automatically shut off, even though the switch may be left on.

The bad news about the FX-700P is the display. Oh, yes, it is very legible and the viewing angle of the LCD elements can be tilted for best visibility, but it is only 12 characters long. When writing programs with two-digit line numbers, that leaves only nine characters visible for the program statement. Oh sure, there is horizontal scrolling, lines can be up to 62 characters in length, and can include multiple statements, but you see only 12 characters at a crack. 'Tain't easy to debug programs this way.

Not that you will be writing very long programs with less than 1K of memory, but it seems to us that a display of 20 characters or 24 (or 31 like the TI CC-40) would have made much more sense.

Calculations and Programs

First and foremost, the FX-700P is a calculator. Moreover, it uses true algebraic logic instead of reverse Polish notation. Parentheses have highest priority as you would expect, and, in the absence of parentheses, calculation begins from the left. Using the FX-700P as a calculator is very natural if you are "coming from" algebra. Of course, if your starting point is a calculator with a different calculation priority, the FX-700P will be a bit confusing at first.

The various functions available are the same as those in Basic, but with several notable additions. In the trig group, we find the usual SIN, COS, and TAN, but also the inverse of each one. Both natural and base 10 logs are available. Functions are included for square roots, exponential, integer value, absolute value, fractional value (a new one for us), sign, random number, and round off. This last one is confusing, only because it is abbreviated RND (the usual random number function call).

As with most calculators these days, memory calculations can be performed. However, because the FX-700P uses kind of a cross between Basic and calculator-speak, it seems much easier to use the memory than with a normal calculator. As with the calculations themselves, things seem rather natural.

The Basic on the FX-700P has very few bells and whistles, but is adequate. There are just 21 statements and commands, and 19 functions. All the basic Basic operators are present except those related to graphics and printing. However, there are no PEEK and POKE machine language commands, no calculated GOTOs or GOSUBs, no Boolean operators, no ON ERROR GOTOs, no CALLs, and no IF-THEN-ELSE.

Perhaps as expected, given the limited memory, there is no group of commands for manipulating data—READ, DATA, or RESTORE. On the other hand, these commands are on the TI CC-40, and we think it would not be unreasonable to expect them in a calculator/computer of this sort.

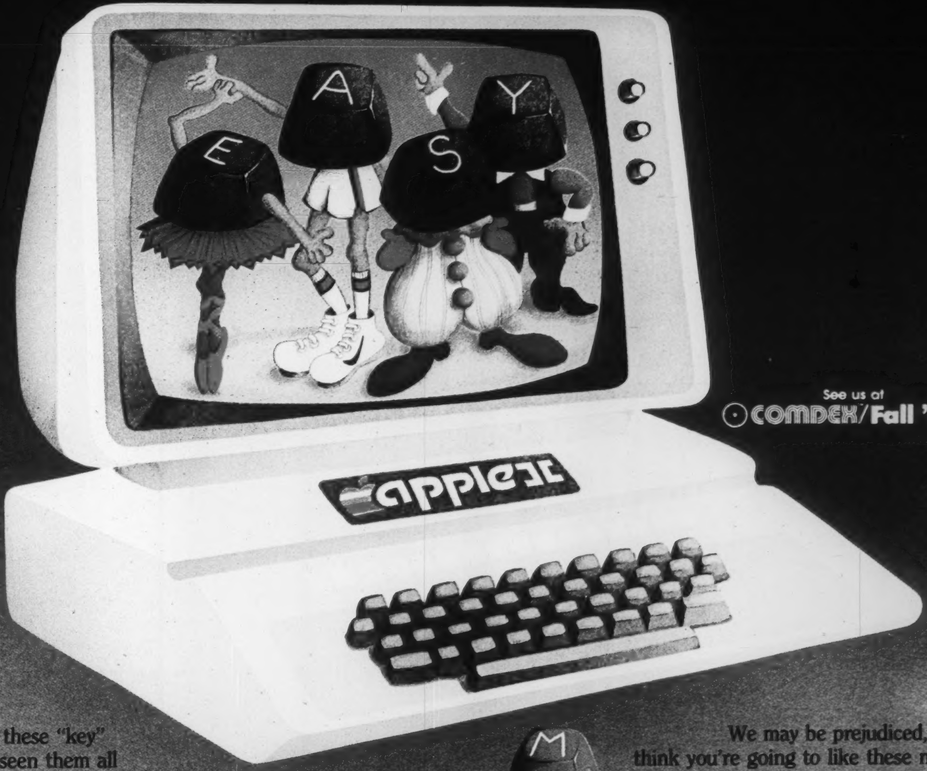
So that is what it doesn't have. Nevertheless, with what it does have, many interesting programs can be written and many complex problems can be solved.

CASIO
CASIO
FX-700P

FX-700P connected to cassette interface and printer measures only 7" x 7".

The Enhancer II™ Proudly Presents

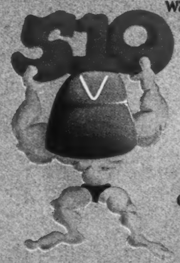
A Whole New Cast of "Key" Characters!



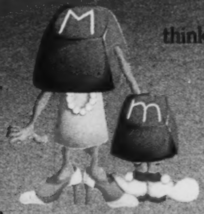
See us at
COMDEX/Fall '83

Recognize some of these "key" characters? You've seen them all before on your Apple® II screen, but now the Enhancer II has given them all new identities!

The Enhancer II uniquely gives your Apple II user-definable keys. So you can define any key to become what you want it to be. That means phrases, paragraphs or commands that you use frequently (up to 510 characters!) can be remembered by the Enhancer II and then called up at the touch of a single key.



Besides that, the Enhancer II gives your Apple II typewriter mode, with each key assuming the identity of a conventional typewriter key. Not only will you recognize all the characters; you'll positively rejoice at having upper and lowercase letters, auto repeat, shift and shift lock again! The Enhancer II also has a typeahead buffer of 128 characters, so you can keep sending messages to your Apple II even while it's busy with something else.



And if you want to meet even more new characters, the optional Function Strip™ will introduce you to 16 brand-new keys across the top of your keyboard which are yours alone to define. (These characters will never get mixed up with characters from the keyboard!)

We may be prejudiced, but we think you're going to like these new "key" characters from Enhancer II. In fact, we'll bet that once you've seen them perform, they'll become the stars of your screen.

Suggested retail prices:
Enhancer II, $149
Function Strip, $79
Combined Package, $215

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The Enhancer II and Function Strip can be used with any Apple with a keyboard encoder board.

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CIRCLE 254 ON READER SERVICE CARD

Casio FX-700P, continued...

What kind of programs and problems? Read on.

Extensive Program Library

Along with the basic FX-700P, and weighing three times as much as the computer, is a paperbound book of programs. This 152-page book is titled simply, Program Library.

The book contains 73 programs in nine areas:

Mathematics	31
Mechanics	10
Statistics	13
Banking	7
Games	6
Electrical Engineering	10
Physics/Chemistry	5
Medicine	5
Navigation	2

Some of the programs in the book border on the trivial (calculation of remainder—three lines), but most are useful and decidedly non-trivial (t-distribution, Bessel functions, acidity of blood, compound annual interest, and astronomical observations).

These programs coupled with the many examples in the 70-page Instruction Manual should help most users get the most from their machines.

```
LIST
  10 Y=0:Z=50:I=0
  20 X=INT (RAN#*50)
  30 I=I+1
  40 PRINT Y;"*";Z;"
     :";I;
  50 INPUT N
  60 IF N=X THEN 100
  70 IF N<X;IF N>Y;Y
     =N
  80 IF X<N;IF N<Z;Z
     =N
  90 GOTO 30
 100 PRINT "HIT:";I
 110 END


READY P0
RUN

 0* 50: 1?
25
 25* 50: 2?
37
 25* 37: 3?
32
 25* 32: 4?
29
HIT: 4


READY P0
```

Figure 1. Program listing and run of guessing game on Casio FX-700P computer and FP-12 printer.

Cassette Interface

How much can you say about a cassette interface? The interface itself is very compact (it adds about an inch to the depth of the FX-700P), and it works reliably. It ought to; it uses the old Kansas City cassette standard (remember the Altair!) of 300 bits per second. Sure, it is slow, but for the length programs you will be saving, it doesn't make much difference.

The cable attached to the interface has the usual three plugs for the earphone, microphone, and motor control jacks on a standard recorder.

Programs are saved with the SAVE command and loaded with LOAD, either with or without a name specified. Data are saved with PUT and recovered with GET; again, file names are optional. One additional command may be used in

Many interesting programs can be written and many complex problems can be solved.

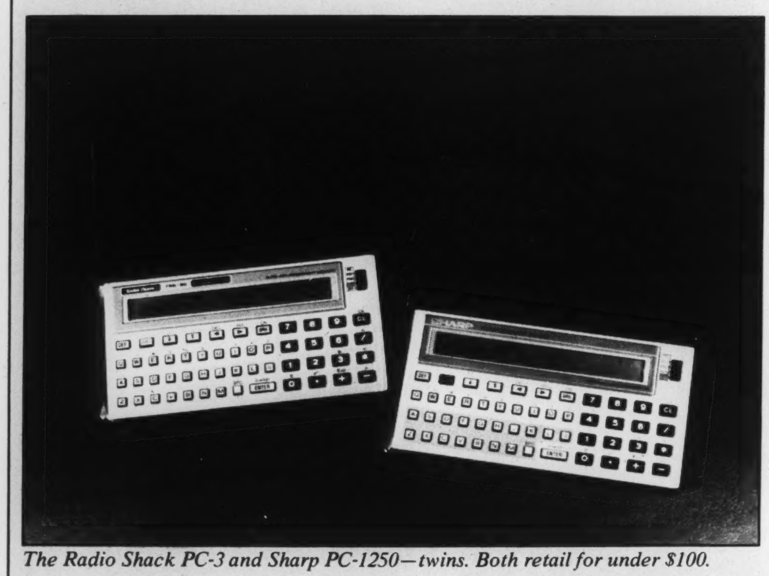
Twins Are A Happy Handful

The TRS-80 PC-3 handheld computer, also known as the Sharp PC-1250, sports a 24-character display—twice that of the Casio FX-700P. The advantage of a wider display is obvious.

These machines are less calculators than Basic learning tools. Neither supports trig functions. But with 1.5K of non-volatile CMOS RAM, a surprising amount of handy applications can live side by side. I use a PC-1250 program to monitor checkbook, credit cards, gas mileage, car maintenance, and appointments, and still have enough room for a couple of diversions.

A printer and cassette interface similar to that available for the FX-700P is also available for these machines.—*JJA*

You might find the keyboard a bit troublesome if your index finger is wider than a knitting needle. With practice, however, it can be mastered.



The Radio Shack PC-3 and Sharp PC-1250—twins. Both retail for under $100.

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Start with Quadcolor I
Quadcolor I adapts to any color monitor and starts you off with 32K of memory. That means that in text mode you get 16 active video pages with a 40 column format or 8 pages with 80 column. Twice as many as IBM's Color Graphics Adapter offers.

When you switch to the graphics mode, Quadcolor I's 32K memory lets you create two complete pages. You can even modify one page while the other is being displayed, for special effects like animation.

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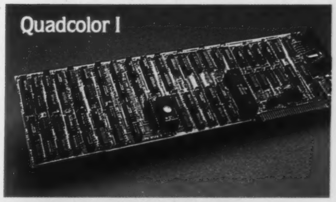
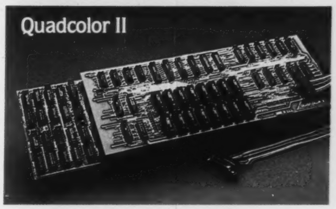

Quadcolor I


Quadcolor II

Quadcolor I also offers support for a light pen and an RF modulator connector for use with a home television set.

Grow with Quadcolor II
As your needs change, plug Quadcolor II into Quadcolor I and get a total of 96K of memory combined with higher resolution bit-mapped graphics. Quadcolor II also includes BASICQ, a software package that enhances the IBM's own BASIC capabilities.

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Display shown on screen produced with Quadcolor II.
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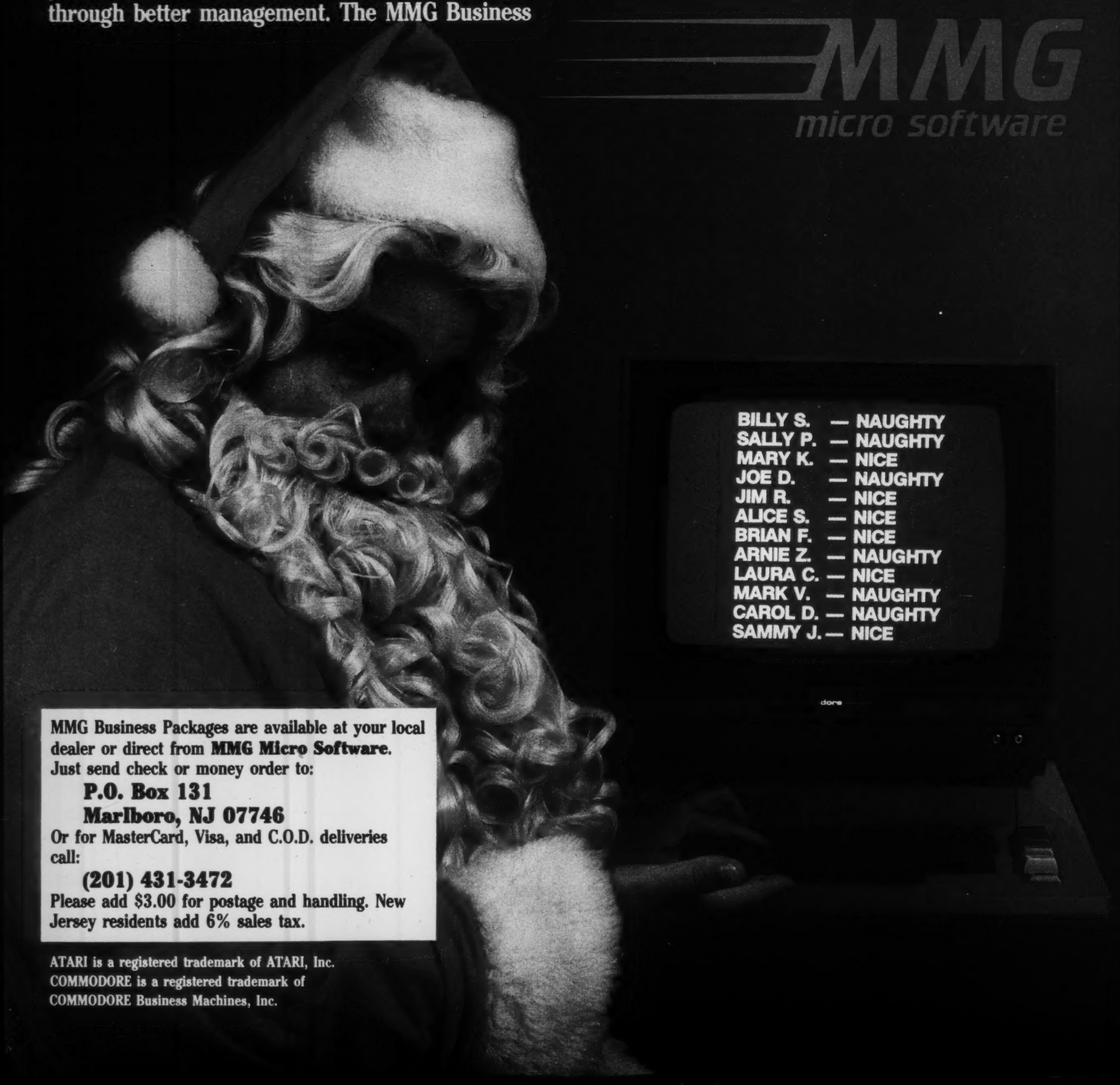
Every year Santa's list gets longer and longer. And all that information can be very confusing. **MMG Micro Software's** Business and Home Management Packages (for the ATARI and COMMODORE systems) can help you organize your business or home for more efficient output through better management. The MMG Business Packages handle accounting, letter writing, billing, payroll and data management. All MMG programs interact to form a complete business or home system. So if you need help making lists—put **MMG Micro Software** on your Christmas list this year.

MMG
micro software


BILLY S. — NAUGHTY
SALLY P. — NAUGHTY
MARY K. — NICE
JOE D. — NAUGHTY
JIM R. — NICE
ALICE S. — NICE
BRIAN F. — NICE
ARNIE Z. — NAUGHTY
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dore

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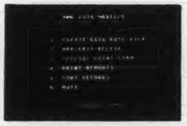
1 CREATE DATA BASE FILE
2 ADD/EDIT/DELETE
4 PRINT REPORTS
5 SORT RECORDS
6 QUIT

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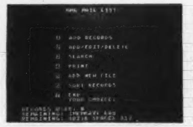
If you frequently find yourself looking for something, only to find it eventually, right under your nose, then MMG DATA MANAGER is for you. Organize virtually anything into a computer-searchable format, and let your ATARI do the hunting for you. This flexible database manager will allow 10 fields, with machine language sorting, on any field. In addition, you have total control of the structure of your data, allowing you to design a database with which you feel most comfortable. A special feature of MMG DATA MANAGER is its ability to select for a given value of any single field, or any combination of values from many fields. You could, for instance, determine who lived in Las Vegas, Nevada, and bought item 3145 from you, and whose last name began with SM, and whose telephone number began with (702) 87. You'll never lose track of information again. Multiple print options add to the versatility of MMG DATA MANAGER. Works with 1 disk drive. Disk only for ATARI.

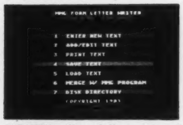
40K $49.95


MMG MAIL LIST
ADD RECORDS
ADD/EDIT/DELETE
SEARCH
PRINT
ADD NEW FILE
SORT RECORDS
END
YOUR CHOICE:

MMG MAIL LIST

Need to establish a mailing list of customers, friends, birthdays, anniversaries or Christmas cards?...or just need to organize things better?...You've got a powerful computer, your ATARI or COMMODORE...put it to work, with MMG MAIL LIST. This is by far the fastest, most versatile such program available for the ATARI and COMMODORE. Completely menu driven, MMG MAIL LIST is extremely user friendly. Extensive error trapping prevents loss of information. MMG MAIL LIST will accept up to six different fields of any kind. The uses of MMG MAIL LIST are limited only by your imagination! You can sort on any field at machine language speeds. Imagine, being able to sort by zip code, by phone area code, by name, by recipe type! Search capability as well; if you remember only a portion of a name, MMG MAIL LIST will find all names beginning with that fragment. Adding records, deleting old records, making alterations in any of your stored information, all functions are supported, and are extremely easy to learn and use. MMG MAIL LIST will print to your screen or any printer, and any configuration of labels can be used. It will even print directly on envelopes! The best part of MMG MAIL LIST is its speed—as much as 50 times faster than competitive products. No more long waits to find information—it's all right at your fingertips! Requires 1 disk drive. Disk only for ATARI & COMMODORE.

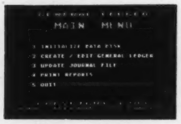
40K $39.95


MMG FORM LETTER WRITER
1 ENTER NEW TEXT
2 ADD/EDIT TEXT
3 PRINT TEXT
4 SAVE TEXT
5 LOAD TEXT
6 MERGE W/ MMG PROGRAM
7 DISK DIRECTORY

MMG FORM LETTER WRITER

The product many of you have requested is now available. Designed to interface with all of the other business packages, the MMG FORM LETTER WRITER will produce a series of customized letters to everyone on your mailing list. A word processor designed specifically for letters, the MMG FORM LETTER WRITER offers full screen editing, saving and recalling letters to and from disk, and a built-in, simple to use interface which allows the sequential printing of letters to each person or firm contained in either the MMG MAIL LIST, MMG DATA MANAGER, MMG ACCOUNTS RECEIVABLE, MMG PAYROLL, MMG ACCOUNTS PAYABLE and MMG INVENTORY database. Inside addresses and salutations are automatically read from MMG MAIL LIST and inserted in each letter as it is printed. Simplifies form letter writing enormously. Requires 1 disk drive. Disk only for ATARI.

40K $29.95


MAIN MENU
1 INITIALIZE DATA DISK
2 CREATE / EDIT GENERAL LEDGER
3 UPDATE JOURNAL FILE
4 PRINT REPORTS
5 QUIT

MMG GENERAL LEDGER

MMG has simplified the use of a General Ledger with this program, so that even a complete novice or a first time computer user will be able to operate this program with a minimal amount of knowledge.

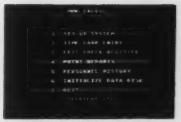
MMG GENERAL LEDGER is a totally menu driven, easy to use package, tailored to the small business. This package can handle up to 999 different accounts. Some are pre-defined which you can use, or create your own for your personal needs.

This package can be used with any parallel printer and supports up to four disk drives.

The MMG GENERAL LEDGER operates all standard reports including: Balance Sheet, Trial Balance, Income Statement and a full listing of all accounts and balances. Any report may be printed on any parallel printer or displayed on the screen. You can display any account instantly. No tedious calculations for balances or totals with the MMG GENERAL LEDGER.

By using the other compatible packages, MMG ACCOUNTS RECEIVABLE, MMG ACCOUNTS PAYABLE, MMG PAYROLL and MMG INVENTORY in conjunction with the MMG GENERAL LEDGER, you can obtain up-to-date financial information on your small business. Requires 1 or 2 disk drives. Disk only for ATARI.

40K $29.95


1 SET UP SYSTEM
2 TIME CARD ENTRY
3 EDIT CHECK REGISTER
4 PRINT REPORTS
5 PERSONNEL HISTORY
6 INITIALIZE DATA DISK
7 QUIT

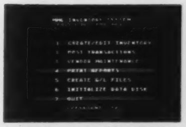
MMG PAYROLL PROGRAM

The MMG PAYROLL package is a totally menu driven, easy to use payroll program, tailored to the small business. The program will handle up to 40 employees and performs all payroll calculations including the printing of checks.

This program can be customized to suit your own personal business requirements. It is extremely efficient and can reduce time spent manually handling those tedious payroll chores by up to 50% or more, and gives you a wealth of information at the touch of a button. The MMG PAYROLL package generates all standard reports including: Earnings Records, Payroll Checks, Check Register, Personnel History, W2 and 941 forms and allows user defined deductions. The use of machine language subroutines increases the speed of this valuable package, while at the same time allows you to change any part of the program to suit your particular requirements.

You may use the MMG PAYROLL package in combination with the MMG GENERAL LEDGER to obtain complete up-to-the-minute financial information. In addition, the MMG FORM LETTER WRITER interfaces with the MMG PAYROLL package to notify employees of tax changes, employee functions, company news, or anything! The MMG PAYROLL package requires 40K of RAM, 1 or 2 disk drives and the ATARI BASIC cartridge. A printer is optional, but recommended. Disk only for ATARI.

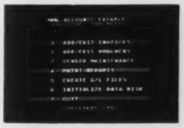
40K $99.95


MMG INVENTORY SYSTEM
1 CREATE/EDIT INVENTORY
2 POST TRANSACTIONS
3 VENDOR MAINTENANCE
4 PRINT REPORTS
5 CREATE G/L FILES
6 INITIALIZE DATA DISK
7 QUIT

MMG INVENTORY CONTROL

Complete control over both your inventory and the costs of maintaining it. Maintains inventory at cost and retail. Provides you with a wealth of information including Last Order Date and Quantity, Vendor, Re-order Point, Number of Items Sold, and much more. Will work as a stand alone package, or in combination with the MMG GENERAL LEDGER. MMG INVENTORY CONTROL interfaces with MMG FORM LETTER WRITER to generate vendor notices, information requests and much more. Requires 2 disk drives. Disk only for ATARI.

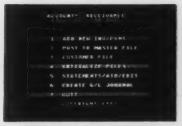
40K $99.95


MMG ACCOUNTS PAYABLE
1 ADD/EDIT INVOICES
2 ADD/EDIT VOUCHERS
3 VENDOR MAINTENANCE
4 PRINT REPORTS
5 CREATE G/L FILES
6 INITIALIZE DATA DISK
7 QUIT

MMG ACCOUNTS PAYABLE

Keeps track of all outstanding obligations, either alone or in combination with MMG GENERAL LEDGER. The program ages your payables and keeps you informed of discounts, dates due and monetary requirements. All record keeping, reporting, and scheduling is managed and it even writes your checks for you! You may utilize MMG ACCOUNTS PAYABLE in conjunction with MMG FORM LETTER WRITER to create letters to creditors, bankers and much more. Requires 2 disk drives. Disk only for ATARI.

40K $99.95


ACCOUNTS RECEIVABLE
1 ADD NEW INV/PYMT
2 POST TO MASTER FILE
3 CUSTOMER FILE
4 INITIALIZE FILES
5 STATEMENTS/AIB/EDIT
6 CREATE G/L JOURNAL
7 QUIT

MMG ACCOUNTS RECEIVABLE

MMG ACCOUNTS RECEIVABLE is a totally menu driven, easy to use program tailored to the small business. This program can be customized to suit your own personal business requirements. It is extremely efficient and can reduce the time spent manually handling accounts receivable by up to 50% or more.

This program can be used with any printer and supports up to four disk drives. Design your own print formats or use the formats on the disk.

The MMG ACCOUNTS RECEIVABLE generates all standard accounts receivable reports including: Invoices, Statements, Customer Listings, and Aged Trial Balances. You can use the MMG ACCOUNTS RECEIVABLE program to generate mailing labels, sort customers, search for customers, and many other options. The use of machine language subroutines increases the speed of this valuable package, while at the same time allows you to change any part of the program to suit your particular requirements.

Use the program in combination with the MMG GENERAL LEDGER to obtain complete up-to-the-minute financial information. In addition, the MMG FORM LETTER WRITER interfaces with the MMG ACCOUNTS RECEIVABLE program to generate sales bulletins, notices, and delinquent letters for your customers. MMG ACCOUNTS RECEIVABLE requires 40K of RAM, 2 disk drives, the ATARI BASIC cartridge and any parallel printer. Disk only for ATARI.

40K $99.95

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CIRCLE 195 ON READER SERVICE CARD

conjunction with the recorder, VER, to verify if a program has been saved correctly.

FP-12 Printer

The FP-12 printer is a thermal printer that plugs into the back of the computer or the cassette interface. As mentioned earlier it is powered by rechargeable NiCad batteries, and comes with a small battery charger.

The thermal paper is 1.5" wide and the print width is 1.1" (20 characters). Paper loading is the easiest we have ever seen; the roll is simply laid in the paper compartment, and the feed switch pressed—that's it!

The MODE key on the computer turns the printer on and off. When it is on, everything that shows on the calculator display is echoed to the printer. Thus there is no need to use special printer commands such as LPRINT or LLIST; indeed, the computer doesn't recognize them. The printer prints either everything or nothing.

Actually, it is even more friendly than that. If you specify a program listing while in the run mode, program lines that require more than one printer line will be indented on the second and following lines (See Figure 1).

The printing is in black on white paper in a 5 x 7 dot matrix. Print speed is a leisurely one line per second.

Multipac Software Package

The Multipac software package was written by Sunrise Software and consists of a group of four rather incongruous programs. One is a spreadsheet, but don't get all excited. *VisiCalc* it is not. The spreadsheet has a maximum of five rows and five columns and simply adds the rows and columns. You use the arrow keys to move about the matrix and change values, and that is about it.

> ***The FX-700P offers an excellent value for the price.***

Jackpot is a simulated slot machine game that accepts your bet for each pull of the handle. After pressing EXE, you either see NO WIN or $$ xx.00. It gets old very fast.

Fone File is a filing system for storing phone numbers. It allows the entry of up to 50 names and numbers. Just think, you can use up the entire memory of your expensive computer storing the same stuff you can write in a 59-cent address book.

Loans is a program to calculate the monthly payments for declining balance loans (are there any other kind?). A similar program is included free in the Program Library book.

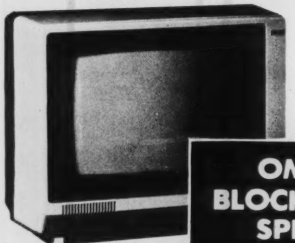
As you can probably tell, we are not at all enthusiastic about Multipac. If your dealer throws it in free with your FX-700P, fine; otherwise, save yourself the $15.

A Pocket Computer For You?

The FX-700P is compact and lightweight, as are the cassette interface and printer. Coming from Casio, they are likely to be quite reliable. All things considered, the FX-700P offers an excellent value for the price.

The bottom line question is: do you need (or want) a pocket computer? If so, the Casio FX-700P certainly merits your consideration. If you are an engineer, technician, or student, or if your work requires lots of repetitive calculations in "field" locations, then this computer would be ideal.

On the other hand, the FX-700P should not be considered a replacement for a desktop or notebook personal computer—one of those two should definitely come first. Also, don't look to it for word processing or for long, complex programs—the display will drive you crazy. END



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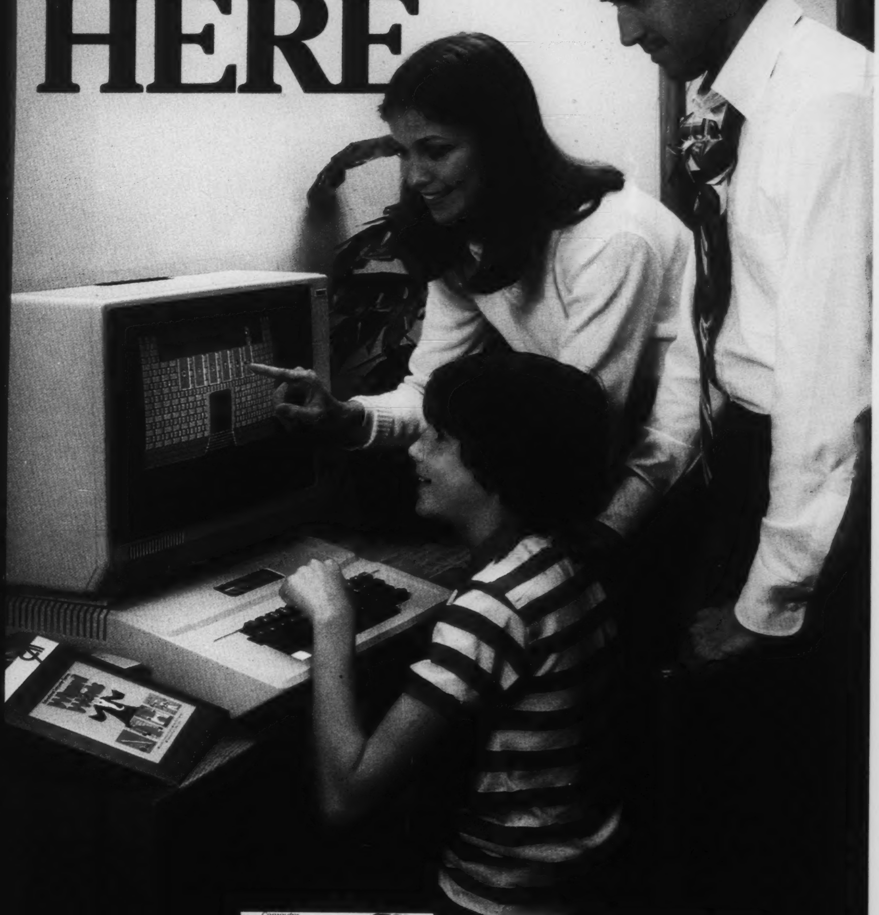

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Wizard of Words
GAME SHOW
TIC TAC SHOW
Byter

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You may meet a princess, a juggler or a dragon in *Wizard of Words.*™ You may appear as a guest on TV in *Master Match,*™ *The Game Show*™ or *Tic Tac Show.*™ Or, you may extend these programs still further with our *LearningWare*™ diskettes, offering hundreds of questions matched to the teaching strategies in the games. In every case, CAI puts a world of imagination and learning at your fingertips. And puts you and your child in control.

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Key features place CAI thinking tools in a class by themselves: Each program comes with its own *library of subjects.* But that's just the start. Our unique *authoring system* let's you or your child create your own lessons on any topic, tailoring the program to your family's needs —and no computer knowledge is required. Add the fact that we've kept the vital ingredient –*FUN*– in learning, and our *proven success* is no surprise. Over 2,000 school districts now use CAI programs to teach essential vocabulary and logic skills in a variety of subject areas.

CAI supports its products —and you —with an unconditional guarantee and a free backup disk. And provides compatibility with the most popular computers: Apple,® IBM® (and soon Commodore™).

Wise Choice

CAI is a group of experienced educators and programmers who believe that success begins with opportunities you create at home. Ask to see a demonstration of CAI programs at your local computer store, and see for yourself just how rewarding a good education can be.

Computer Advanced Ideas CAI™

Bringing Ideas Home

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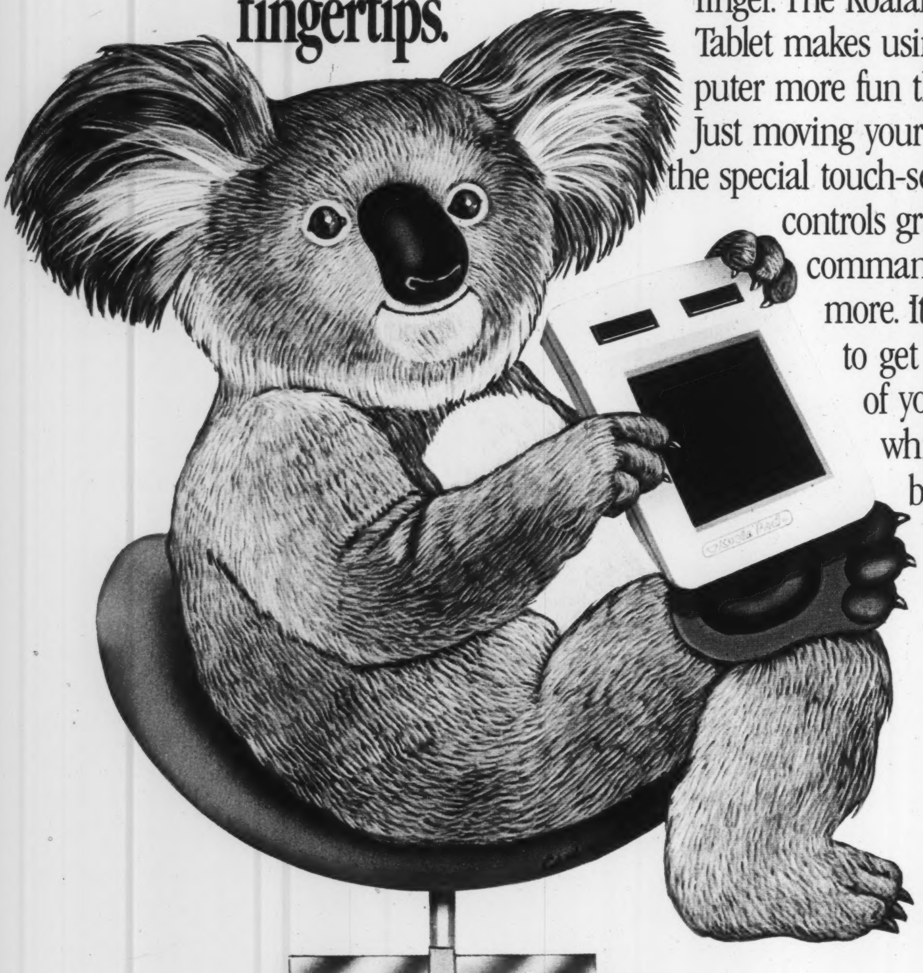
CIRCLE 130 ON READER SERVICE CARD

How to get in touch

KoalaPad™ Touch Tablet puts the controls at your fingertips.

Paint the screen with colorful graphics or play lightning-fast games with just a touch of your finger. The KoalaPad™ Touch Tablet makes using your computer more fun than ever before. Just moving your finger across the special touch-sensitive surface controls graphics, game commands, and much more. It's a great way to get the most out of your computer while you just sit back and

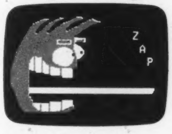


with your computer.

relax. The KoalaPad fits comfortably in the palm of your hand for easy use. And once you have it in your hands, it's hard to put down. That's because the KoalaPad does much more than joysticks, paddle controllers or the "mouse." Each KoalaPad set is packaged with a KoalaWare™ graphics program* for creating beautiful, high-resolution graphics right on the screen. And that's just the beginning.

DANCE AND MY BEAR

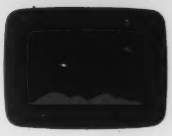
Dancing Bear™ *brings a funny, furry cabaret star right into your home where your own programmed performances will win applause every time.*



Spider Eater™ *the game that attacks musical education with a voracious appetite, taking a bite out of the task of learning the musical scale.*

There's a full line of KoalaWare programs to choose from with a perfect combination of entertainment and education. Add a touch of excitement today to your Apple,® Atari,® Commodore® or IBM® computer. See the KoalaPad Touch Tablet at the computer store nearest you. To locate the dealer in your area, call toll free 800-227-6703. (In California, 800-632-7979.)

Logo Design Master™ *uses computerized graphic design to help children and adults learn the basics of programming and prepare for more advanced applications.*



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Koala Technologies Corporation,
3100 Patrick Henry Drive,
Santa Clara, Ca. 95050

*Software included with Touch Tablet varies with computer type.

KoalaPad, LPS II Light Pen, and Robographics CAD-1

creative
computing
equipment
evaluation

Drawing Conclusions

John J. Anderson

What is the best method for drawing or drafting with a computer? What are the best peripherals available to help you reach this goal? What capabilities might you expect for your money, and how soon will today's state-of-the-art system become obsolete?

As more talented but "right-brained" types of people become involved with computers, meaning interested non-programmers, these questions are increasingly asked. As technology advances, the answers are fortunately becoming better.

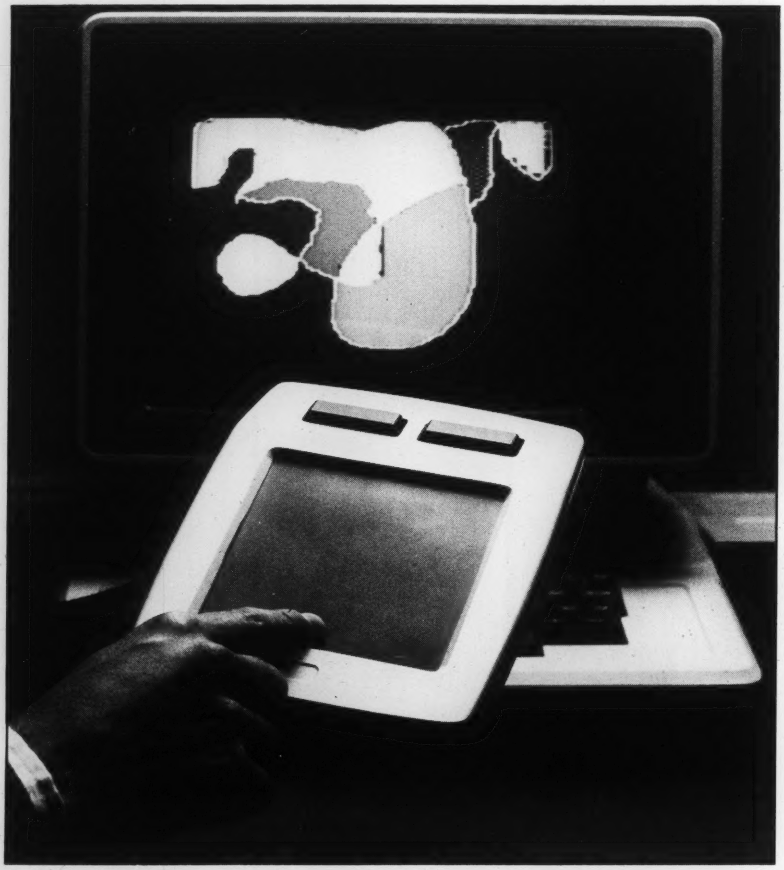
If you have over $10,000 to spend on a graphics system, good for you. There are some very powerful machines out there, beckoning for your investment.

We shall be concerned here with three much less expensive systems for the Apple computer which, nevertheless, span a rather broad price range. Each is a combination of custom hardware and custom software, presented as a complete package. Each has its own advantages and unique peccadilloes. One uses a tablet peripheral, one a light pen, and the third a specially designed precision joystick-style controller.

Why not start expressing your artistic urges or redesigning the kitchen aided by your Apple.

In deciding which type of system you want to buy, consider the kinds of input you wish to do. Are you drawing cartoons, preparing presentation slides, or drafting serious architectural renderings? Do you wish to output to a color printer or plotter? What are the final forms you wish your drawings to take?

If the video screen is the ultimate destination, do you want to achieve animation? (Take a look at the review of *The Graphic Solution* in the July 1983 issue of *Creative Computing*.) If you are designing textiles or need access to dozens of colors, maybe an Atari computer is what you need (along with *Paint*, reviewed in the March 1983 issue).



KoalaPad controller.

I
ADORE
MY 64

It writes, rates, creates, even telecommunicates. Costs less, does more-the Commodore 64.

When Commodore introduced the 64, the industry suddenly realized that there would be a computer in every home, school and business years before anyone ever dreamed.

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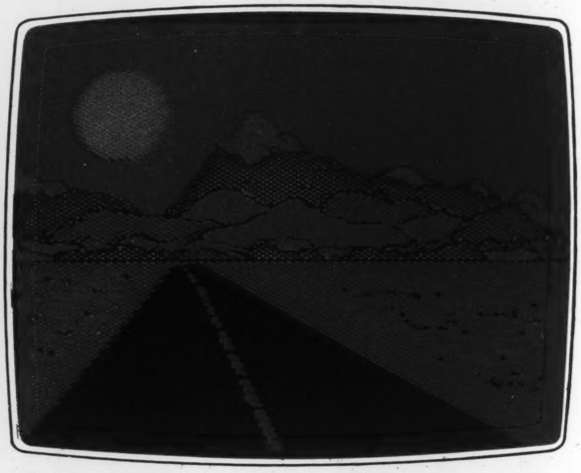
What can you do with it? Create with its high resolution Sprite Graphics. Add a printer and type with it. Add a disk drive to use spread sheets and other financial programs. Learn and play music through your home sound system on the 64's professional quality music synthesizer.

Add a modem, and hook up with the vast computer networks through your telephone. In short, the Commodore 64 is the ultimate personal computer, at a price you can afford.

CIRCLE 133 ON READER SERVICE CARD

COMMODORE 64



The new generation of true graphics tablets is headed by the *Chalkboard* (see the October 1983 issue). We have also heard that Apple will shortly introduce its own tablet. An inexpensive mouse controller recently became available for the Apple from Wico. It can act as a serviceable graphics input device.

creative computing
SYSTEM PROFILE

Name: KoalaPad Touch Tablet

Type: Graphics system

System: Apple, IBM, Atari, Commodore 64

Format: Custom input peripheral plus software.

Specifications: Touch tablet peripheral plugs into joystick port, uses same input lines. Micro Illustrator software provides sophisticated graphics capabilities.

Performance: Nested window approach rivals the performance of Apple Lisa.

Ease of Use: Excellent

Documentation: Very good

Price: $125 for Apple version.

Summary: Inexpensive entry into the realm of hi-res graphics design. An excellent peripheral, sure to be of use in software packages to come.

Overall Mark: Very good

Manufacturer:
Koala Technologies Corp.
4962 El Camino Real
Suite 125
Los Altos, CA 94022
(415) 964-2992

So, why not start expressing your artistic urges or redesigning the kitchen aided by your Apple. You can invest little more than $100, or over $1000. But the invocation is the same.

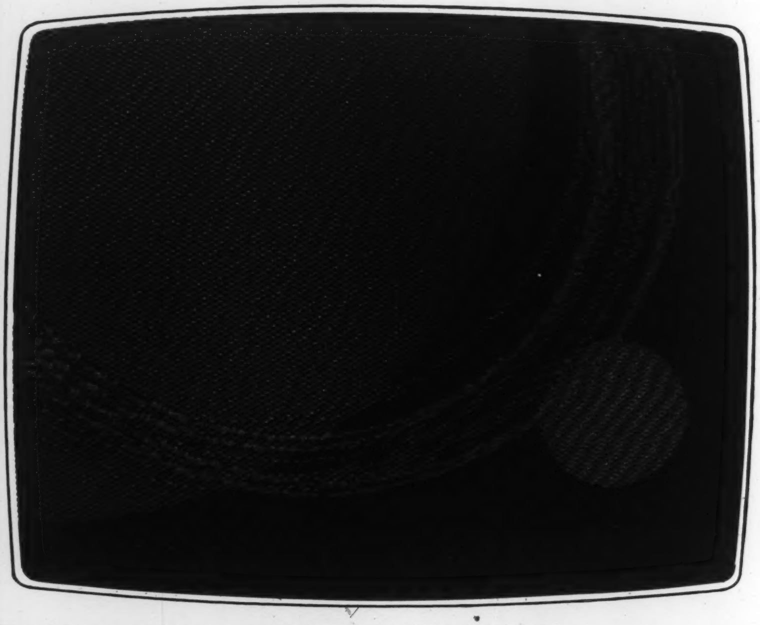
Draw, pardner!

KoalaPad

The concept of the graphics tablet has been with us for some time. To create an image by moving a stylus over a flat surface is a very natural and pleasing means of input. It also offers control with a steady hand.

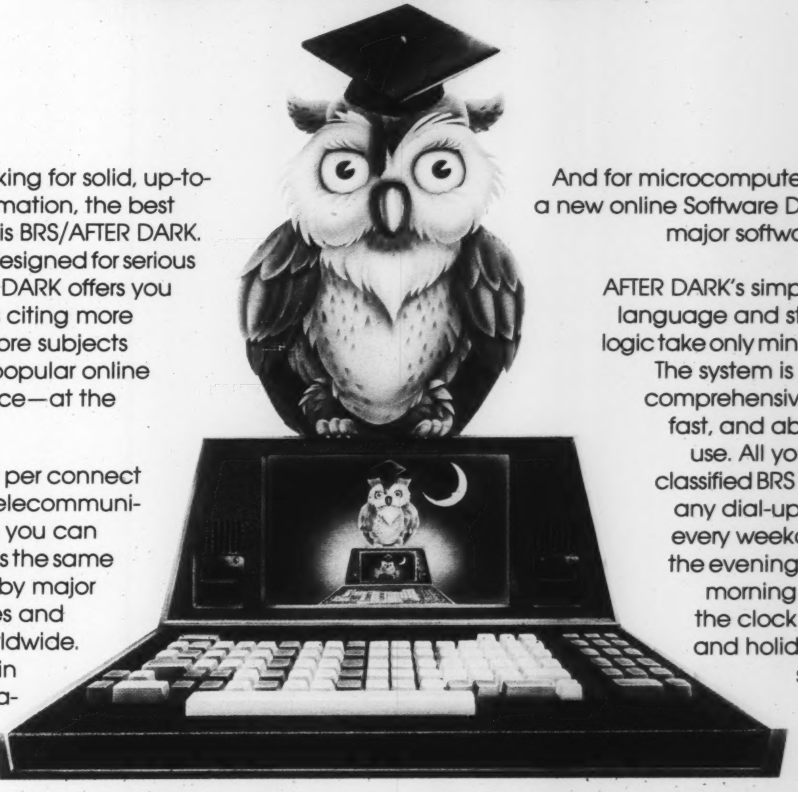
The device has remained until this time, however, a complicated and expensive technological proposition. Typically, tablets incorporate complex switch mechanisms, bringing the total cost to more than $600. Graphics tablets have also been known to throw off a good deal of RFI (radio frequency interference), which makes both neighbors and the FCC unhappy. The tablets may also have a tendency to go haywire now and again.

As has been the case with nearly every computer and peripheral you can name, the cost of the graphics tablet has, in spite of any shortcomings, continued to drop, while reliability has increased. Recently the KoalaPad touch tablet made



The pictures on this page were all designed with the KoalaPad.

"There's No Time Wiser Than After Dark."



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CIRCLE 119 ON READER SERVICE CARD

And for microcomputer buffs, there's a new online Software Directory listing major software packages.

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CC 12/83

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its debut, and more or less revolutionized the technology.

Whether the KoalaPad should truly be called a graphics tablet is hard to say. It certainly looks like one and functions like one. However, the drawing surface is much smaller in scale—the product seems to fit somewhere in between a joystick and an actual graphics tablet.

When you begin to play with a KoalaPad, you appreciate its capabilities in short order. At a suggested retail price of $125 for the Apple model, you may draw your own conclusions. You can draw a whole lot more, too, using the superlative software that accompanies it.

The Apple KoalaPad plugs into the game controller port, just as if it were a joystick. It also has two switches, and in fact can be used in some existing paddle and joystick applications. It draws 5 volts from the host computer.

Software

The real potential of the KoalaPad becomes obvious, however, only when you run specially designed Koalaware software for it. Then it is transformed into an artist's input device rivalling the power of a full-fledged graphics tablet, but at a reasonable price.

> ***Automatic modes make drawing straight lines, rectangles, circles, discs, and blocks as easy as pi.***

The package *Micro Illustrator* is supplied with the KoalaPad itself. This is one of the most powerful inexpensive drawing utilities I have seen for any microcomputer. It is a menu-and-pointer-based program, which uses the tablet as an input peripheral. You choose a selection by pointing on the pad, with either a finger or a stylus. This moves the on-screen cursor to the desired choice. You then confirm the choice with the press of a button.

This system of nested windows is an especially friendly way to make decisions, and closely follows the format used by Apple Lisa software. A quick indicator of its ease of use is the dramatic evidence provided by non-computer-types when they sit at a machine running *Micro Illustrator*. With almost no coaching, they begin to lose their inhibitions and start drawing. The combination of hardware and software creates a system with the power to make a first-time user lose track of time.

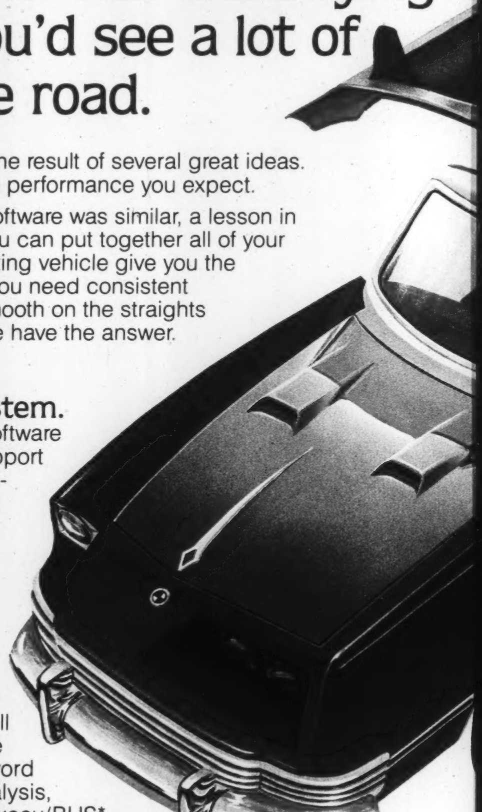
I love to create images with computers and have used nearly every program designed to do this on a host of machines. I have never seen any package with features to match the Koala system for the price.

Drawings can be saved as hi-res Apple screens and quickly accessed from Applesoft or other graphics programs. While the only available solid colors are the artifact groups red, blue, purple, green, white, and black, other color variations are made possible by plaiding. Unfortunately, the color and plaid menus are fixed and not user-definable.

Automatic modes make drawing straight lines, rectangles, circles, discs, and blocks as easy as pi (even easier than that, nonmath folks). Drawing these shapes could not possibly be simpler (see photos).

Ease Of Use

But artistic potential is not the only reason I view the KoalaPad as a "breakthrough." It is, as an input device, like its cousin the mouse, an intelligent and simple alternative to keyboard commands. The KoalaPad is even *more* convenient to use



If buying a car was like buying software, you'd see a lot of these on the road.

A flashy vehicle. No doubt the result of several great ideas. But hard to drive with the performance you expect.

Until now, buying business software was similar, a lesson in irregular mechanics. Sure, you can put together all of your own pieces, but will the resulting vehicle give you the performance you expect? If you need consistent operation, easy response, smooth on the straights yet tight on tough corners, we have the answer.

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than a mouse, because no free desk space is required to operate it. In addition, it uses fewer moving parts—and so is less prone to failure.

If you have still not admitted to the viability of the mouse as a computer peripheral, you may not see the KoalaPad as a breakthrough. Get smart. I have seen what an easy user interface can do for people intimidated by keyboards. They expedite learning, and can make the task of wading through command decisions intuitively obvious—just point to what you want. This potential should not be underestimated.

Unfortunately, it frequently is, especially by seasoned users who fail to see the problem a keyboard may pose for others. More's the pity.

For the handicapped, the advent of products like the KoalaPad may make interaction with computers a much less taxing activity than it is currently. It is my hope that Koalaware and other software houses will take a long, hard look at the utility of pointing peripherals as an interface for physically disabled computer users.

The pad has also been released for Atari, IBM, and Commodore 64 computers.

LPS II Light Pen

I have always had an affinity for the light pen as a peripheral. As opposed to using a joystick, graphics tablet, or mouse, working with a light pen is utterly analogous to working with a normal pen. No guesswork. No training period. The eye and the hand work together at the same point on the screen.

I like light pens so much I once went as far as to design one—*Creative Computing* published the plans. Everything you needed to build it could be obtained from the neighborhood Radio Shack. It fit into a penlight. It had a touch ring. It was neat. The only problem was it didn't work quite as well as it might have.

The Gibson Light Pen, in contrast, works *extremely* well. It is, in fact, one of the most impressive peripherals available for your Apple computer. Its capabilities are nearly unlimited.

In terms of the immediacy of freehand drawing, nothing comes close to the Gibson package. You really feel as if you are

creative computing
SYSTEM PROFILE

Name: LPS II Light Pen

Type: Graphics system

System: Apple II, Apple IIe

Format: Custom input peripheral plus software.

Specifications: Light pen connects to slot 7 (or other slot) on Apple motherboard, with epoxied interface card. Penpainter software uses pen as pointer to select functions. Pen can also be accessed from Basic.

Performance: Superlative. Among the most impressive packages available for the Apple.

Ease of Use: Good, while not as smooth as KoalaPad.

Documentation: Good. A bit sketchy in places, though.

Price: $250

Summary: When new driver software and tip-switched pen become available, LPS system will be unbeatable. As it stands, still a winner.

Overall Mark: Excellent

Manufacturer:
Gibson Laboratories
23192-D Verdugo Drive
Laguna Hills, CA 92653

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The benefits are simple to achieve.

Your capability develops quickly since all programs respond to similar commands. And you can transfer data between any combination of programs with just a few keystrokes. The result lets you concentrate more on your ideas, and less on the system details. That means more productivity, the performance you expect.

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High-Resolution
High-Speed
LPS II
Light Pen System for
Apple II Computers

LPS II light pen and controller card.

drawing. And in fact, you are, in a 1:1 ratio of pen movement to screen plot. This means you can draw with nearly all the freedom of freehand, and have the result look very much as if you had drawn it on paper.

The Gibson pen is attached to a board that fits in slot 7 of your Apple computer. The pen wire sticks out from under the top cover of the machine. Boot the pen software, and you're off.

Software

The software is not nearly as polished as that of the KoalaPad, but it can accomplish many of the same tasks, and more. It is not nearly as much of a pleasure to use, but it includes some very interesting features. Mirroring allows you to create symmetrical shapes across the X, Y, or both axes. An animation utility is offered for constructing multiple shapes. Means of accessing the light pen from Applesoft is also provided.

The Penpainter program allows fill plaids to be defined by the user—a very pleasing feature. In addition, any fill can be used over any other fill. This is a rarity in graphics programs. Usually because of the way the program is designed, one fill pattern cannot pre-empt another containing duplicate colors.

I should say more about the software currently accompanying the pen, but a new, absolutely mind-blowing package is now being developed. From the demonstration Gary Wells recently gave me, this new software appears to rival the Lisa in its monochrome nested window approach. Suffice to say my mouth was hanging open. The package will be made

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Wargames

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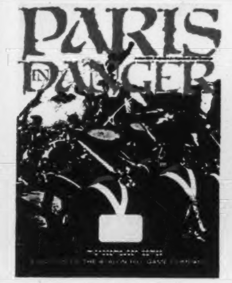
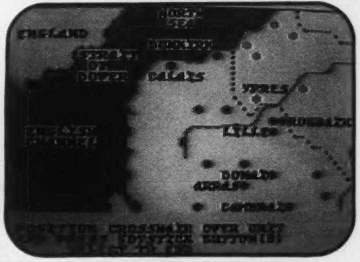


Strategic Level



Paris in Danger: A simulation of Napoleon's 1914 campaign in France. One of Napoleon's finest, against the invading Allied Armies. (Austrian, Prussian and Russian). You can choose to take the role as Napoleon, Commander Schwarzenberg, or play both sides to re-create the actual campaign. PARIS IN DANGER is unique, in that it allows the players to compete on both the strategic and tactical levels, on a full-color scrolling map of France and surrounding countries.

For all Atari Home Computers, 48K Disk: $35.00

Tactical Level

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LEGIONNAIRE (by Chris Crawford):

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Wargame of the Year, VIDEO GAMES PLAYER Magazine
Nominee for Wargame of the Year, Game Manufacturers' Association

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For all Atari Home Computers, 16K Cassette: $35.00
32K Diskette for Atari Home Computers: $40.00
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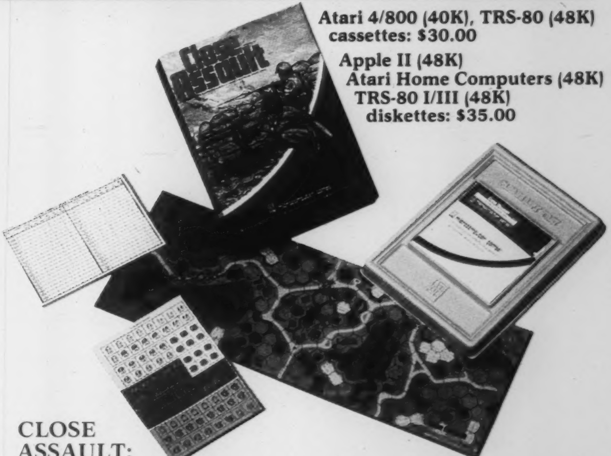

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THE VERDICT IS IN

"Odesta has set the standard against which everyone else in this industry will be measured..." Ian Chadwick, InfoAge 6/83

Checkers 2.1 by David Slate

"It's a textbook tutorial on a disk... a primer on artificial intelligence."
Softalk 3/83

"...a gold-plated edition of a classic."
Apple Dayton Journal 3/83

Chess 7.0 by Larry Atkin

"Chess 7.0 is the definitive chess game available on the Apple and Atari computers... It is certainly the best chess program that I have seen for any microcomputer."
The Book of Apple Software 1983

Odin by Larry Atkin & Peter Frey

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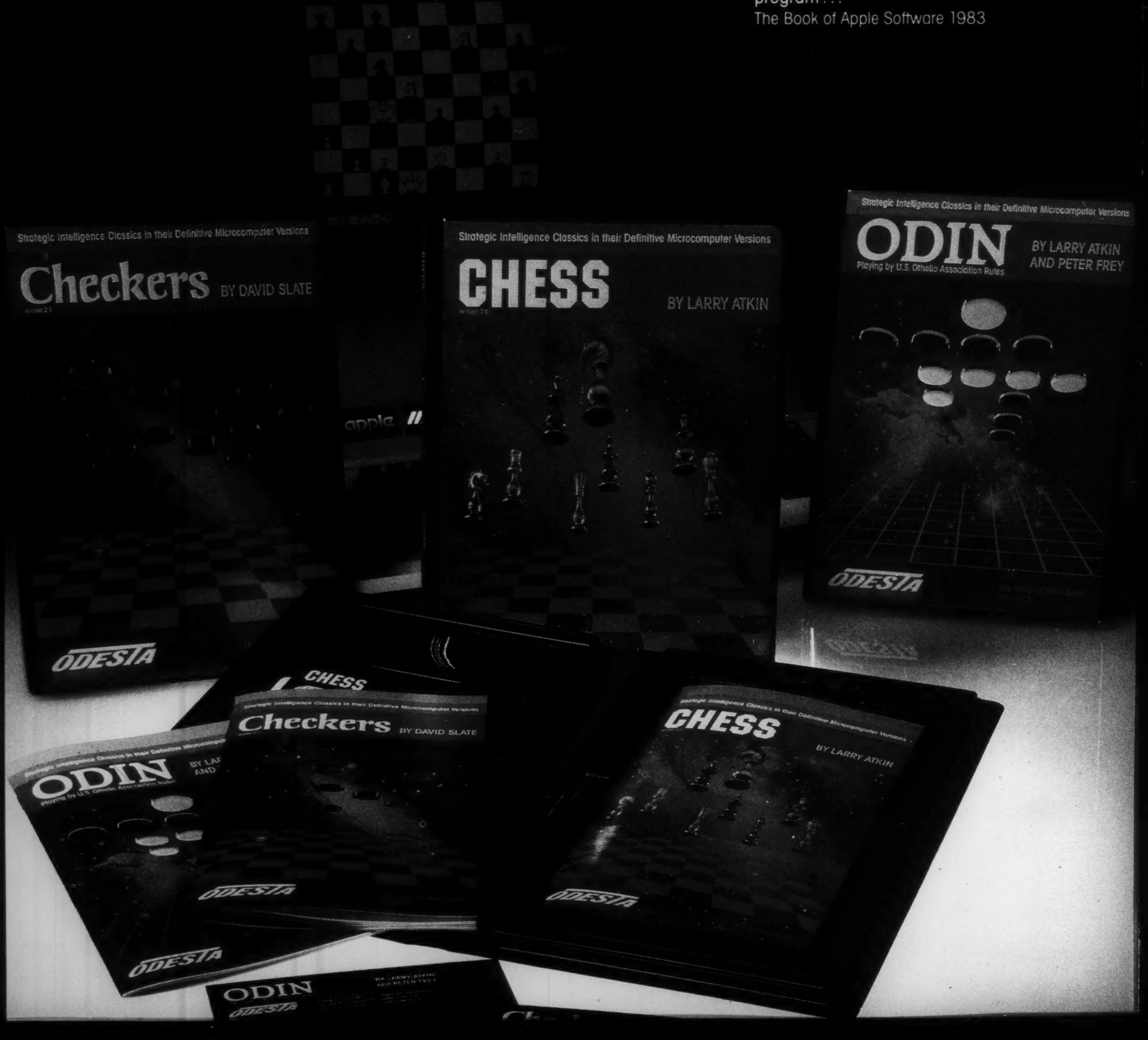
Softalk 11/82

"Odin is the definitive Othello program..."
The Book of Apple Software 1983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Checkers BY DAVID SLATE
CHESS BY LARRY ATKIN
ODIN BY LARRY ATKIN AND PETER FREY
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apple //

THANKS

We gratefully acknowledge the many positive comments that we have received in response to **Chess 7.0, Checkers 2.1,** and **Odin.**

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In 1982, we introduced **Chess 7.0**, by Larry Atkin. For the first time, the chess player could save games to disk, take back moves easily, learn from classic games, use a **real** manual, enjoy an extensive opening library, fast play, a smart end-game, and in general work with a program **designed** to extend his or her own reach. **Chess 7.0** also played better than any other chess disk on the market. And although other programs are now beginning to offer some of **Chess 7.0's** features, **Chess 7.0** is still, by far, **the** learning, analytical tool for the chess person. Decide for yourself – ask your dealer to show you the interactive chess game where you get better, not bored.

Announcing New Versions

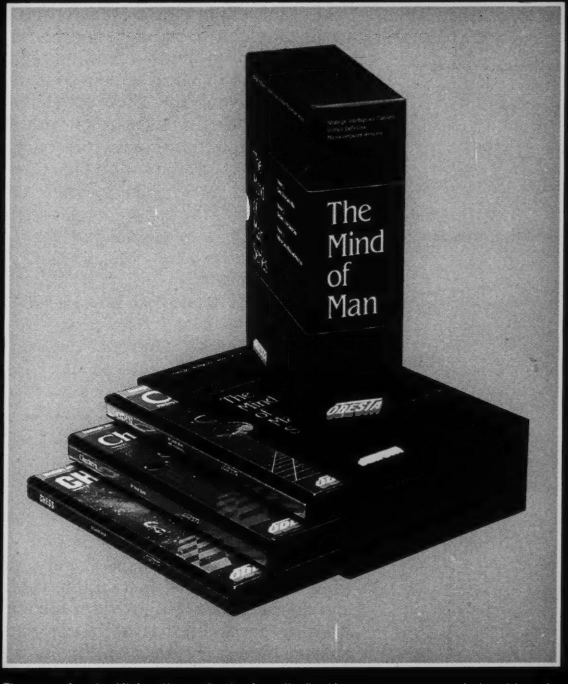
Chess 7.0, Checkers 2.1, and **Odin** are now available for the **IBM PC** and **Commodore 64**. Thanks for waiting.

More Feedback

From Neil Shapiro, Popular Mechanics "PM Software Monitor" 5/83: "The Best in Chess ... all the options make playing a game with **Chess 7.0** more like having a conversation with a chess teacher than playing against a machine."

From Jonathan Cerf, former World Othello® champion "... an extremely formidable opponent – in most situations, **Odin's** play is world class by human standards." Othello Quarterly, summer '83.

The Best are Now Boxed!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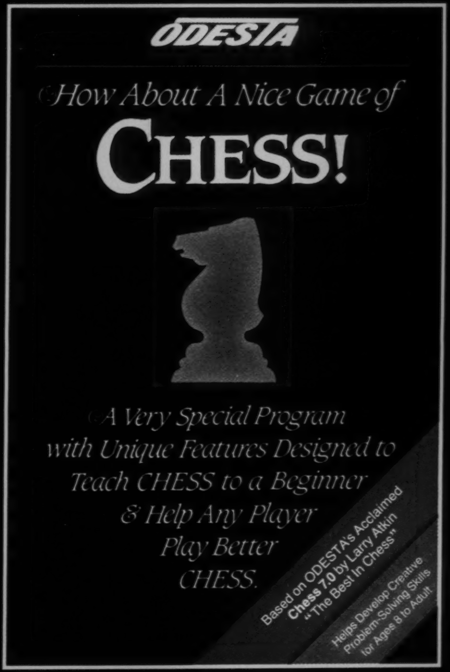
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How About A Nice Game of Chess: $29.95
Mind of Man Set: $145.00

For:
Apple® II, III
Commodore® 64
IBM® PC
Atari® 400-1400

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CIRCLE 199 ON READER SERVICE CARD

Designed with the LPS II.

LPS II fill patterns make Harry a natty dresser.

available at a nominal charge to all current owners of the pen, and will be included with the pens themselves in future releases.

The last time I saw Steve himself, he was providing a colorful demo of his new pen for Atari computers. That model sported a tip switch, and it shouldn't surprise me if we shortly saw a tip switch on the Apple version of the pen as well.

Criticisms

There are only two criticisms I might possibly raise of a quality light pen, such as the LPS II. As pointed out to me by Dick Kushner, the user's arm tires after holding it to a CRT for awhile. Holding the pen out horizontally is definitely a greater strain than working with gravity on a graphics tablet, mouse, or track ball. The light pen is probably not an ideal peripheral for use by the handicapped. If the user can rest an elbow on the desk or table in front of a display, however, this effect is minimized.

The LPS II is a great buy at $250.

Also, for a light pen to work properly, it must detect a strong light source from its screen. This means that drawing cannot take place on a black screen. With the LPS system you can work on a white background, then reverse color with the push of a button (this trades artifact colors in the process, turning red to blue, green to violet, and vice versa—somewhat annoying). Or you can choose a mode wherein a small patch of white follows the pen around an otherwise dark screen. An ingenious solution.

The LPS II is a great buy at $250. I didn't like the way its spy-proof epoxy case pressed on my controller card when snuggled into slot 7, but you can't have everything.

Robographics CAD-1

The CAD-1 system from Robographics marks a radical departure from the graphics systems discussed so far. While most of the kinds of drawing possible with the KoalaPad or LPS II systems are also possible with the CAD-1 system, the CAD-1 can do much more. It provides technical drafting capabilities rivaling computer-assisted design systems costing tens of thousands of dollars.

The most significant aspect of the Robographics system is its final output: rather than a hi-res Apple screen, it can save graphics data that can then be sent to a drafting plotter.

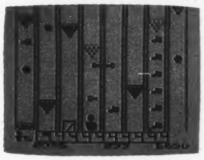
The standard peripheral used for input with the CAD-1 is a precision joystick module. It includes a high quality joystick, a disc-type potentiometer, and three pushbuttons (see photo). It plugs into the existing

X and Y axis symmetry with the LPS II.

DON'T LAUGH. FIVE MINUTES OF ALLEY-OOPS AND YOU WON'T BE ABLE TO TAKE YOUR EYES OFF IT.

Oh sure—it might look silly now. But wait'll it's hurtling toward you, threatening to destroy your perfect game. You'll take it seriously then.

And bowling shoes won't be your only worry. You'll also have to watch for diabolical beer bottles, evil pin sweeps and vicious gum spots.



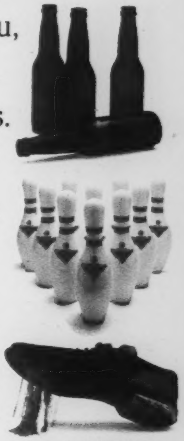
Sound strange?

Sure. But battling such weird objects is exactly what makes Alley-Oops so original. And so incredibly fun to play.

Alley-Oops is real arcade stuff. In fact, it's a challenge just to get to the next level of play. And there are 8 levels, the last one being the nearly impossible Challenge Round.

There are all kinds of ways to play Alley-Oops—try to mount up points, score a perfect game or reach that highest level. Whichever way you choose, you'll have endless fun playing Alley-Oops.

Just remember—don't take the bowling shoes lightly. After years of being kicked around bowling alleys, they're out to get even.



To survive Alley-Oops, you'll have to contend with diabolical beer bottles, evil pin sets, and vicious gum spots.

Alley-Oops™—A new arcade game from Artworx.® Designed by Jeffrey Godish and Brian Harkins; programmed by Leonard Bertoni and David Pompea. For the Commodore 64 and Atari (16K) computers. Cassette/diskette $29.95. Artworx Software Co., Inc., 150 North Main St., Fairport, N.Y. 14450. For a free catalog of Artworx software write or call 800-828-6573.

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game I/O socket on the Apple II or Apple IIe, which must be equipped with a minimum of 64K and two disk drives. The controller is solid, heavy, and has a feel that sets it leagues apart from any other Apple joystick one may be tempted to compare it with.

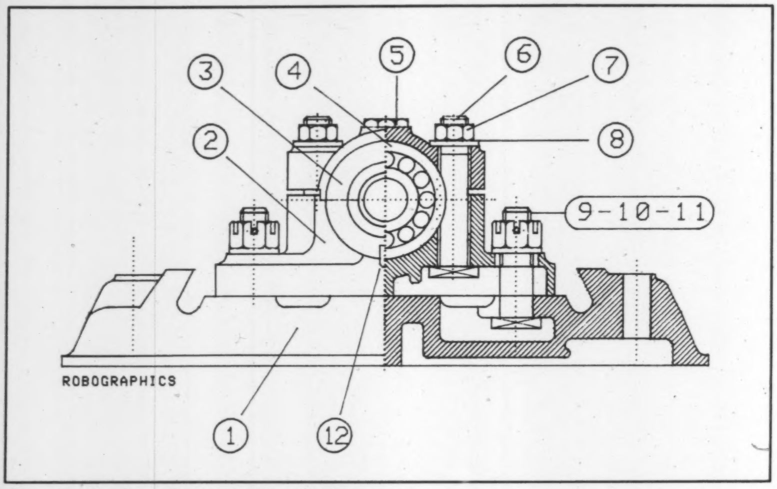
I must admit that I am not as enamored of the joystick approach as I am of the graphics tablet or light pen approach. Although the CAD-1 stick is a precision instrument, it is not as easy to handle in the freehand mode, nor is there any feeling remotely resembling the act of drawing. Fortunately, the system can also handle input from other peripherals.

Software

Then there is the software side of CAD-1. The system master disk loads the main graphics program into the computer. The screen comes up with a menu display, outlining textual and graphic menu selections (Figure 1). Text runs down the righthand side and graphics across the bottom of the screen. This arrangement makes choosing the commands you want about as straightforward as possible. Use the joystick to move the on-screen cursor until it highlights your selection: press the lefthand button to confirm the selection.

If you choose the selection "menu," a second menu of choices appears down the righthand side of the screen. This sequence of nested menus makes operation of the CAD-1 system very simple.

If and when you want to get rid of the menu, to use the entire available screen area for your drawing, use the command "full." This removes the "palette" from the screen area.



Sample plot from Robographics CAD-1 system.

> ***A sequence of nested menus makes operation of the CAD-1 system very simple.***

And so you may begin drawing. You may select the shape of your line, its color, and its type (continuous or one of three sorts of dotted). One of the more interesting and convenient features of CAD-1 is its ability to move backward or forward through every step of a drawing sequence. If you make a mistake, just back up the number of steps it takes to get you out of it. If you move back too far, move forward to the desired step. As opposed to a single body of updated screen data, CAD-1 remembers and can recreate all the steps in a drawing.

This is the departure that makes it possible to drive a plotter. It also allows a plotter to eradicate the problem known as *aliasing*, wherein diagonal or curved lines become jagged-looking. The kind of data saved as CAD-1 drawings will map straight diagonals and curving arcs—opening up possibilities not available with screen-based systems.

Robographics CAD-1 controller.

Library

The other feature lending remarkable power to CAD-1 is its Library capability. The Library disk contains a graphic index of miniature drawings, any of which can be obtained, scaled, and modified for use with original drawings. If you are an architect, for example, you may store commonly used architectural symbols (standard or of your own design) and retrieve them for use as necessary. Aside from the ability to scale the size of the unit, it can be rotated in steps of five degrees and "stretched" or "squeezed." Library entries themselves can be composites of other library entries—or original work.

The CAD-1 system, of course, includes the capability of generating circles. But it does not stop there. By using the "squeeze" command, a circle can be turned into an ellipse. In addition, tangent arcs can be drawn between selected points, with selected radii. This is an extremely handy feature.

A Paint selection is offered to allow quick fill-in of outlined shapes, but affects only the monitor display—not a plotter

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CIRCLE 129 ON READER SERVICE CARD

Inside Apple

Vol. 1, No. 4

A dot matrix printer that will improve your image.

Meet the Apple® Imagewriter, the newest dot matrix printer for your Apple Personal Computer.

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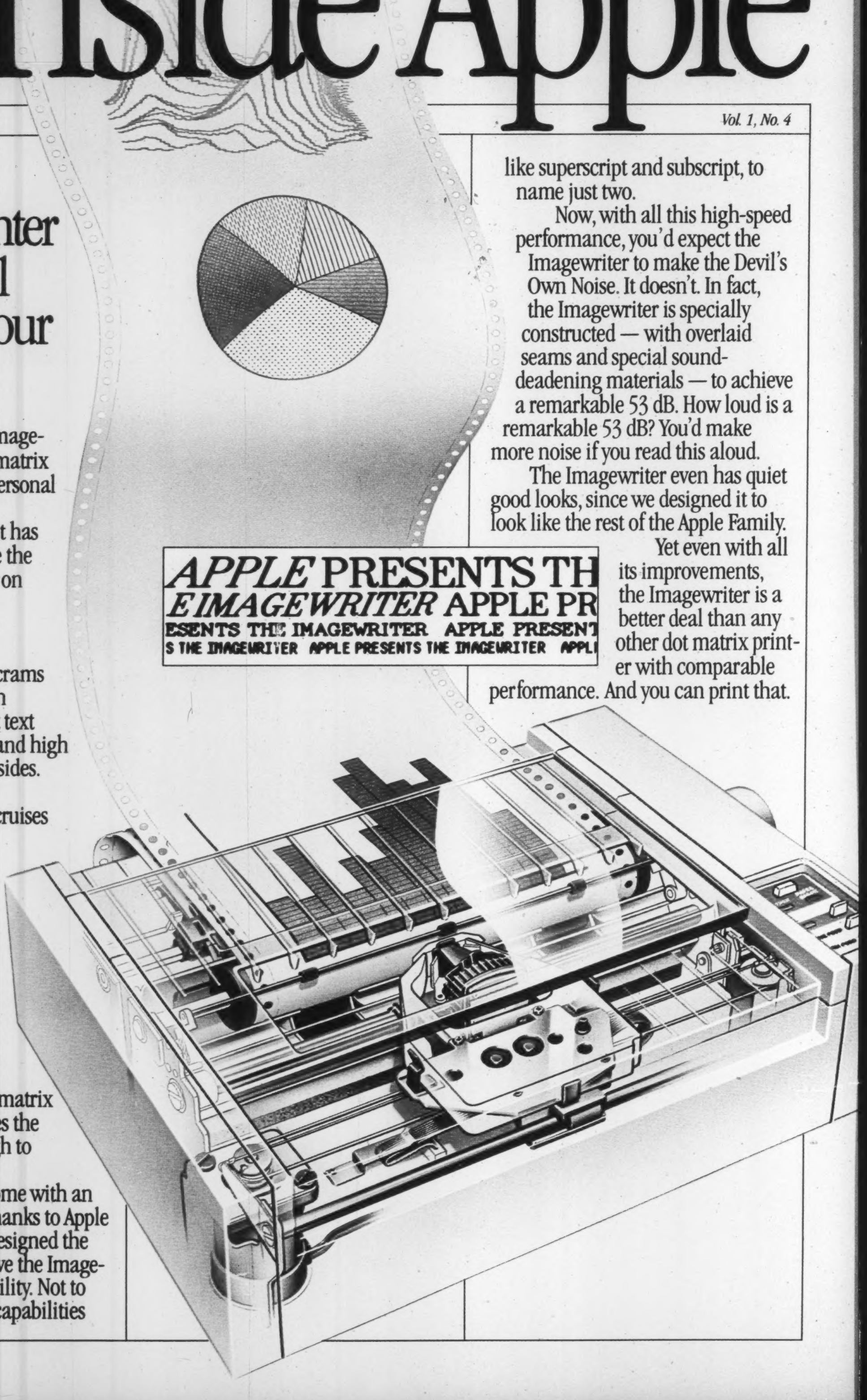
Now, with all this high-speed performance, you'd expect the Imagewriter to make the Devil's Own Noise. It doesn't. In fact, the Imagewriter is specially constructed — with overlaid seams and special sound-deadening materials — to achieve a remarkable 53 dB. How loud is a remarkable 53 dB? You'd make more noise if you read this aloud.

The Imagewriter even has quiet good looks, since we designed it to look like the rest of the Apple Family.

Yet even with all its improvements, the Imagewriter is a better deal than any other dot matrix printer with comparable performance. And you can print that.



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What kinds of programs will work with ProFile and Catalyst? Almost anything written for the Apple III including copy-protected programs like VisiCalc,® Quick File™ and Apple Writer III. Or languages like Pascal, BASIC, or COBOL.

And once you've loaded these programs into your ProFile, the only diskette you may ever need is the Catalyst.

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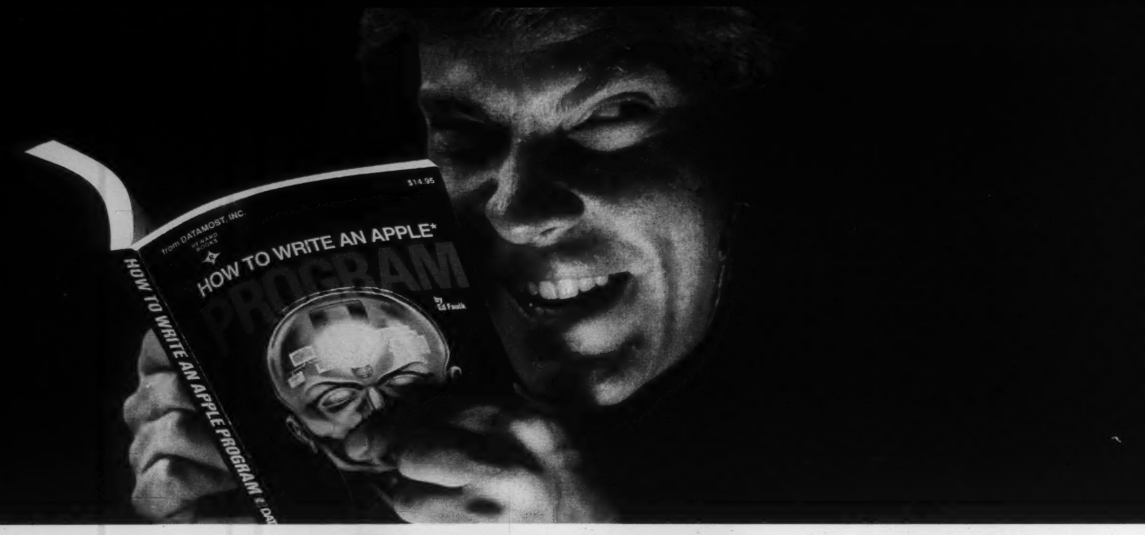
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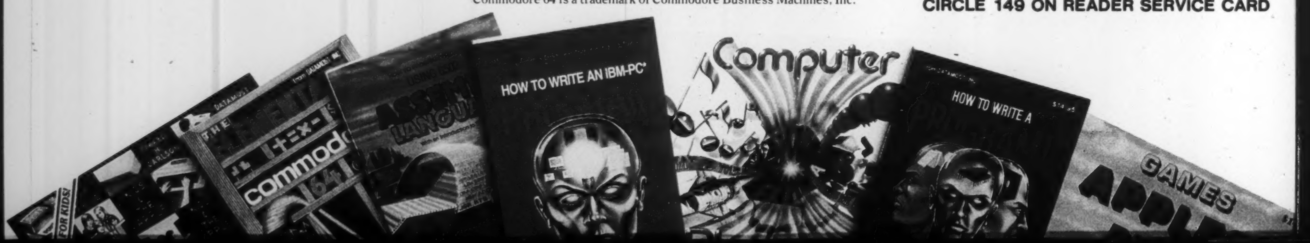

output. However, a feature called Nib allows filling in areas either solidly or with hatching effects, to appear eventually on the plotted page.

The command Text allows text blocks to be added easily to an existing drawing. During entry it can be rotated in steps of 90 degrees. By transferring it to the Library, however, it can be scaled and rotated with greater flexibility.

Zoom

Of course the screen size and resolution of the Apple II would seem to present a limitation to the CAD-1 system. This is not the case. The magnifying capability called Zoom allows detail to be added to a specific area of a larger drawing. You may then return to the original base page scale, while the detail added in the Zoom mode remains.

You may Zoom as often as you like to any desired level of magnification (within eventual constraints of memory). You may then invoke the command Pan to view off-screen areas of the drawing at that same level of magnification. So it becomes clear that the size of a base page need not be limited by the size of the screen display. You can access all the detail you need—even to create highly complex plans.

In addition to using Zoom to draw added detail, disk library units can be nested within each other at different magnifications. This feature may impart to you the tremendous potential of the CAD-1. Object drawings stored in the CAD-1 system can encompass an incredible level of detail, visible as you Zoom through a range of scales.

In addition, CAD-1 can "Flip" library units into mirror images along the X or Y axis. Colors can be altered; drawings can be moved, duplicated, even animated using commands from the CAD-1 menu. And, using the auto edit feature, a library unit can be updated so that all subsequent appearances of that unit will also be updated. In this manner a single design change need not necessitate the redrafting of an entire project. Simply redefine an original component on the same library disk as an assembly component that references it. All references will automatically be updated.

> ***CAD-1 has the ability to create drawings to meet a very high technical standard.***

If you wish to save data as hi-res Apple screens rather than as plottable graphics indices, CAD-1 allows this also.

Other Features

Some handy drafting aids have been included with the system. I am not a draftsman, but a hobbyist. Still, I can see clearly that CAD-1 has the ability to create drawings to meet a very high technical standard. According to the comprehensive

creative computing

SYSTEM PROFILE

Product: Robographics CAD-1

Type: Graphics system

System: Apple II, Apple IIe, 64K, two drives

Format: Custom input peripheral plus software.

Specifications: Super high quality joystick unit with disc-type potentiometer and three buttons. Connects via interface to game controller port. Multidisk software and plotter drivers provide advanced capability.

Performance: Excellent. Easy to obtain plotted output without aliasing or mathematical functions.

Ease of Use: Good. Takes a bit of learning, but manageable.

Documentation: Excellent. Holds your hand all the way.

Price: $1100

Summary: Well worth the price for advanced drafting capabilities and plotter features. Nested levels of detail foreshadow things to come in graphics systems.

Overall Mark: Excellent

Manufacturer:
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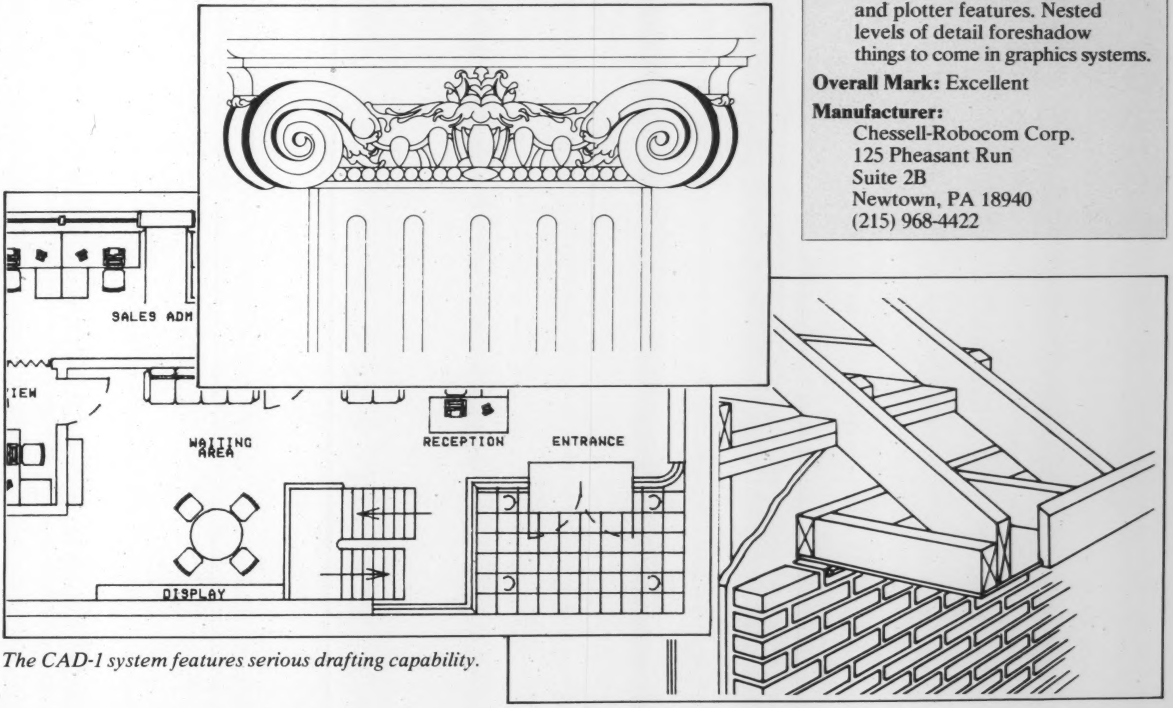

The CAD-1 system features serious drafting capability.

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Drawing Conclusions, continued...

and well-written documentation accompanying the package, "you have at your disposal a range of precision aids which can be used with the same effect as traditional graph paper, scales, protractors, and other drawing instruments...End points will be accurately defined, lines will meet where they are supposed to, curves will blend smoothly, parallel lines will be just that, and text will be consistent in size and position." I have no argument with these claims.

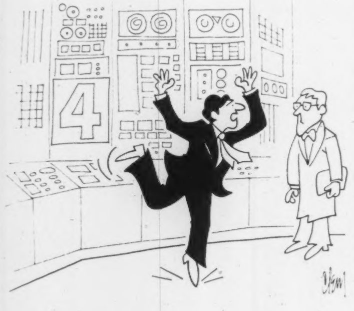
There is, for example, a feature to lock cursor movement. You can limit the cursor to select a locked range of angles or grid points. You may use these locks in combination, as well, to set a skewed grid. Grids can be scaled, giving the same effect as different scales of graph paper.

The Scale function further allows a locked grid to be set at specific metric dimensions, wherein the base page size can be set to any value between 1 mm and 1000 km. You may set the base page value to the actual size of the object you wish to draw; the computer will then display the nearest larger base page that offers convenient grid spacing. When Zoom is invoked, the program automatically rescales the screen grid to the desired magnification, maintaining true scale.

Summary

The CAD-1 system is costly, currently listing for $1095. For this price, however, it represents the most advanced drafting system available for any microcomputer under $3000. It quite probably offers more features than the typical reader of *Creative Computing* seeks. But, if it is professional drafting capability you are looking for, you will not find a better package.

The ability to send output to a plotter is critical—and CAD-1 allows the user to get a plotter working at full potential. The nested levels of detail possible with the system points in the direction of things to come. END



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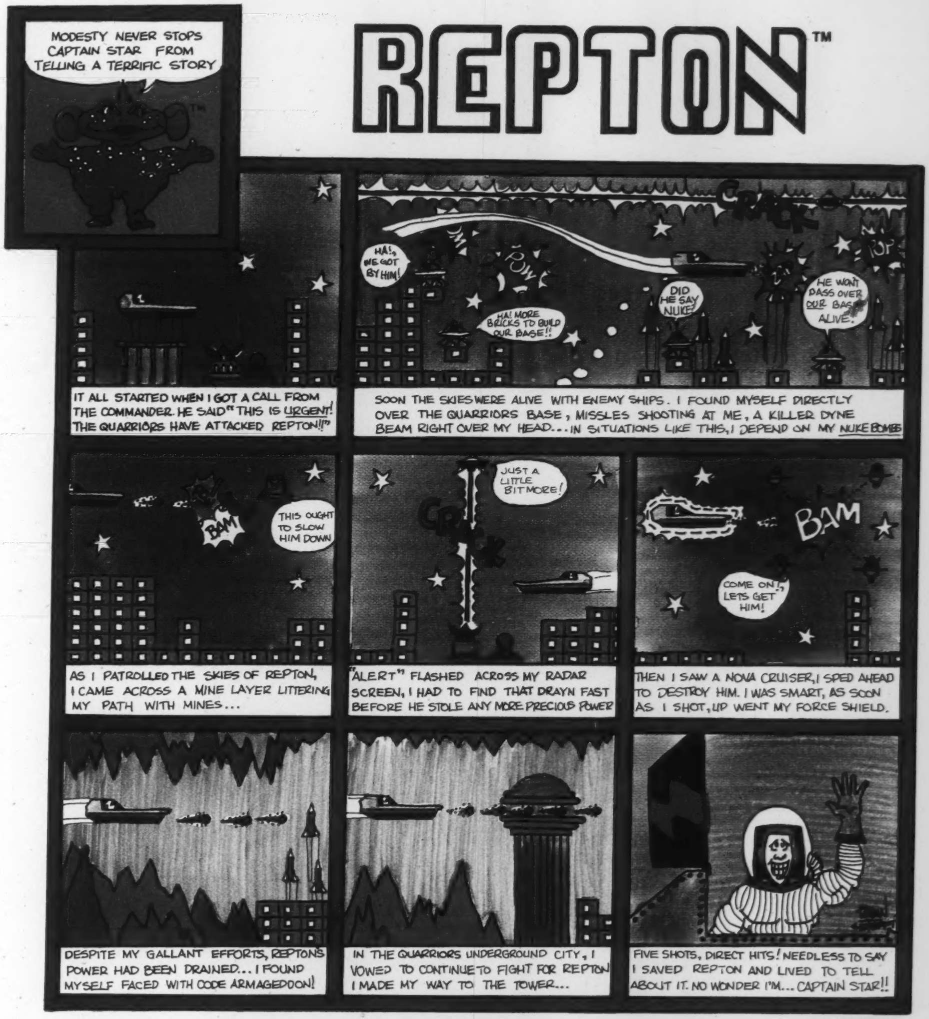
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TM
IT ALL STARTED WHEN I GOT A CALL FROM THE COMMANDER. HE SAID "THIS IS URGENT! THE QUARRIORS HAVE ATTACKED REPTON!!"
HA!, WE GOT BY HIM!
HA! MORE BRICKS TO BUILD OUR BASE!!
DID HE SAY NUKE?
HE WON'T PASS OVER OUR BASE ALIVE.
CRACK
SOON THE SKIES WERE ALIVE WITH ENEMY SHIPS. I FOUND MYSELF DIRECTLY OVER THE QUARRIORS BASE, MISSLES SHOOTING AT ME, A KILLER DYNE BEAM RIGHT OVER MY HEAD... IN SITUATIONS LIKE THIS, I DEPEND ON MY NUKE BOMBS
BAM
THIS OUGHT TO SLOW HIM DOWN
AS I PATROLLED THE SKIES OF REPTON, I CAME ACROSS A MINE LAYER LITTERING MY PATH WITH MINES...
JUST A LITTLE BIT MORE!
CRACK
"ALERT" FLASHED ACROSS MY RADAR SCREEN, I HAD TO FIND THAT DRAYN FAST BEFORE HE STOLE ANY MORE PRECIOUS POWER
BAM
COME ON!, LETS GET HIM!
THEN I SAW A NOVA CRUISER, I SPED AHEAD TO DESTROY HIM. I WAS SMART, AS SOON AS I SHOT, UP WENT MY FORCE SHIELD.
DESPITE MY GALLANT EFFORTS, REPTONS POWER HAD BEEN DRAINED... I FOUND MYSELF FACED WITH CODE ARMAGEDDON!
IN THE QUARRIORS UNDERGROUND CITY, I VOWED TO CONTINUE TO FIGHT FOR REPTON I MADE MY WAY TO THE TOWER...
FIVE SHOTS, DIRECT HITS! NEEDLESS TO SAY I SAVED REPTON AND LIVED TO TELL ABOUT IT. NO WONDER I'M... CAPTAIN STAR!!

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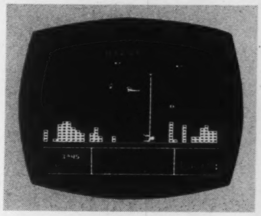

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Commodore 64 Disk
Apple II, II+ & IIe Disk

Game design by Dan Thompson and Andy Kaluzniacki

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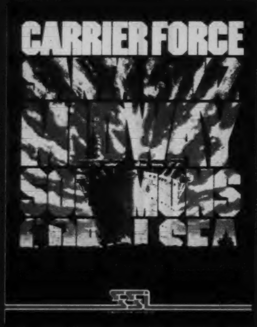

2.

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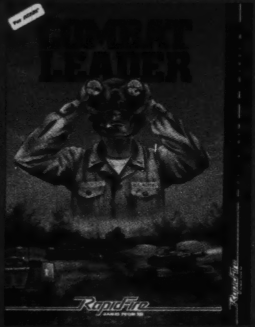

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FORTRESS
RapidFire
GAMES FROM SSI

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BALL IN PLAY
100
100
RapidFire
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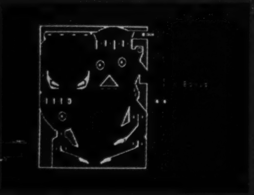

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The New Blue Apple

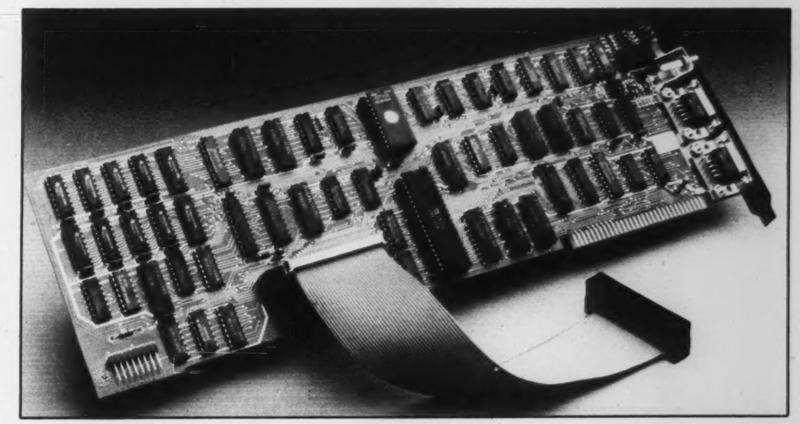
Quadlink Makes Your IBM Think It's An Apple

Stephen Arrants

In 1980, the Quadram Corporation entered the microcomputer market with a selection of add-on boards for the Apple. The Microfazer and Interfazer print buffers were well-designed and popular. When the IBM PC was introduced, Quadram came out with an add-on memory card, a dual-printer card, and a battery powered clock card. In 1982 these special cards were bundled together into one card for the IBM PC as the Quadboard. Now comes the Quadlink, a card designed to run Apple software on a PC.

At a cost of $680, the Quadlink isn't designed for the casual, home user. For businesses with a large investment in Apple software or a company using different microcomputers, the Quadlink offers software portability between the two most popular business microcomputers.

The Quadlink package consists of the Quadlink card, three cables, an instruction manual, and two disks. The circuit board has 80K of RAM. When the Apple mode is selected, 16K holds Apple instructions, leaving 64K for your programming applications. Quadram decided not to place Apple ROM on the card, thus avoiding a potential lawsuit. The card also contains disk drive controller and video display circuitry. The 6502 microprocessor is also present. What you have, then, is an Apple computer on one card— an amazing feat.



Installation

Installation is involved, but not too difficult. The Quadlink is designed to fit into one slot on the expansion bus. You don't just plug it in and run it, though.

Three cables are supplied. The first cable connects the Quadlink to the disk drive controller. You must disconnect the cable from the controller and attach it to a connector on the Quadlink. Then connect the Quadlink to the disk controller. Next, disconnect the speaker wire from the PC motherboard and attach it to the Quadlink. Take the speaker cable supplied and attach it to both the motherboard and the Quadlink. If you have game controls, connect them to the Quadlink at this time.

Check all connections again to make sure they are correct. A wrong connection could ruin both the Quadlink and the PC. Re-install any cards you may have taken out, and put the cover back on. If you are using an IBM supplied or RGB monitor, take the last cable and plug one end into the video display card and the other into the top mini-D socket of the Quadlink. That's it. Installation is complete.

To see if the installation was a success, boot PC-DOS, insert the Quadlink disk in drive A and type QUADLINK EXE. At the prompt, type in CTRL ALT A. The system then prompts you to insert the Filer disk and enter CTRL ALT DEL. If all went well with the installation, Apple DOS 3.3 takes over, and your PC now thinks it is an Apple. If you don't see the familiar Apple prompt,], but get sent into the Apple monitor, try rebooting the Filer disk again.

If both drives start whirring, strange noises come from the speaker, or anything else out of the ordinary happens, *Turn off the Power!* Open the PC and recheck your connections. If everything still looks O.K., check with your dealer.

> ***The Quadlink will run on the PC-XT, but cannot use the hard disk.***

Performance

The 24 x 40 display looks like an Apple screen, down to the formation of letters and graphics blocks. Since Quadlink shares the disk drives with the PC, disk action is similar. When Quadlink is installed and running, the IBM PC *is* an Apple.

Quadram claims that most Apple and Apple-compatible software will run on the Quadlink. Random tests I performed proved this to be true. Table 1 lists the software that I was able to run and also the software that gave the Quadlink some problems.

I worked on a PC with Quadlink installed for a day, treating it like an Apple. I ran *Apple Writer,* and some products I am in the process of reviewing and then re-ran them on the Apple. Text files created with the Quadlink were completely readable on the Apple. Anything saved on the PC drives was transferable.

There are a few caveats when running Apple software, however. If the program uses any elaborate protection scheme, such as half-tracking or PEEKing at a specific Apple memory location, it will not work with the Quadlink. Look out for programs that read from serial/parallel, cassette, or keyboard ports.

The Quadlink will run on the PC-XT, but cannot use the hard disk. Also, don't expect to use more than one Quadlink in a PC.

Documentation and Software

The User's Guide comes in a ring binder and is enough to get you started. It briefly discusses the differences between the Apple and the IBM PC, different operating systems, Applesoft and error messages, installation and operation. Also included is a bibliography for further reading on the Apple. If you are serious about using a Quadlink, try to get manuals on Applesoft Basic and Apple DOS.

Software consists of the Quadlink disk and *The Filer* from Central Point Software. *The Filer* is a utility disk which performs disk back-up, file utilities, a disk speed check, and a disk system check. It also acts as your system master disk, installing DOS when booted.

Summary

If you have an IBM PC but need to run Apple software, the Quadlink may be the solution you have been waiting for. Installation is relatively easy, and most Apple software will run on the Quadlink. At $680, it is considerably cheaper than an Apple IIe.

The Quadlink shouldn't hurt the Apple market. Rather, it should help to broaden and enhance it. END

Table 1.

Software For The Quadlink

This list is not inclusive, use it as a guide. When in doubt, test before you buy.

The following software will run with the Quadlink in operation.

Software	*Publisher*
AppleWriter 1	Apple
AppleWriter II	"
Apple DOS System Master	"
Jumpjet	Avante-Garde
Bank Street Writer	Broderbund
Lode Runner	"
VisiCalc	Visicorp
VisiPlot	"
The Complete Graphics System II	Penguin Software "
Hayden Applesoft Compiler	Hayden
Reversal	"
Sargon II	"
MagiCalc	Artsci
Magic Window	"
Plasmania	Sirius
Freefall	"

The following software did not run on the Quadlink.

Software	*Publisher*
AppleWriter IIe	Apple
QuickFile IIe	
Think Tank	Living Videotext, Inc.
The Incredible Jack	Business Solutions

Also, software that uses half-tracking protection schemes, reads serial/parallel, cassette, or keyboard ports, or that checks a specific area or Apple ROM. Software designed to run *exclusively* on the Apple IIe will not run on the Quadlink.

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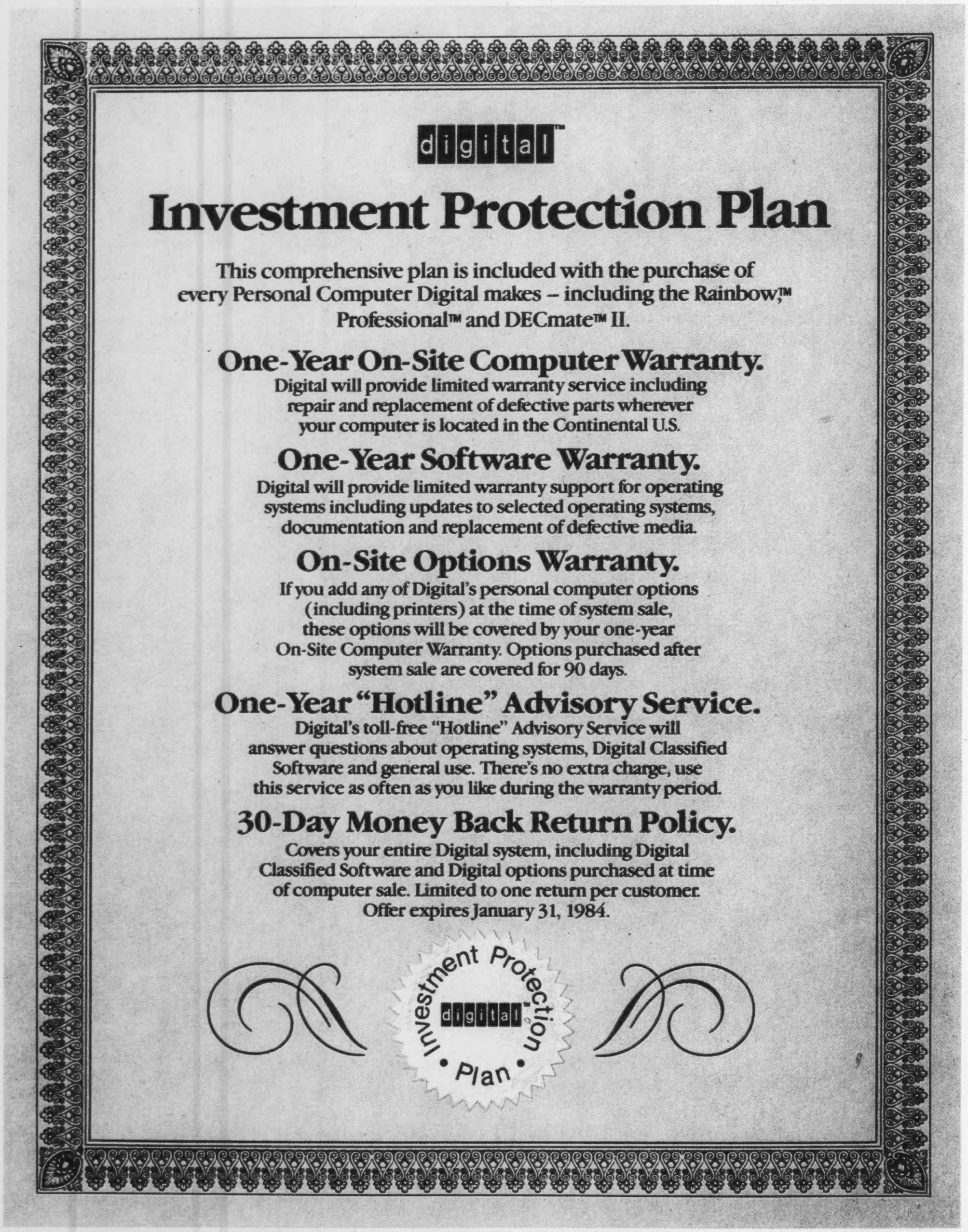

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30-Day Money Back Return Policy.
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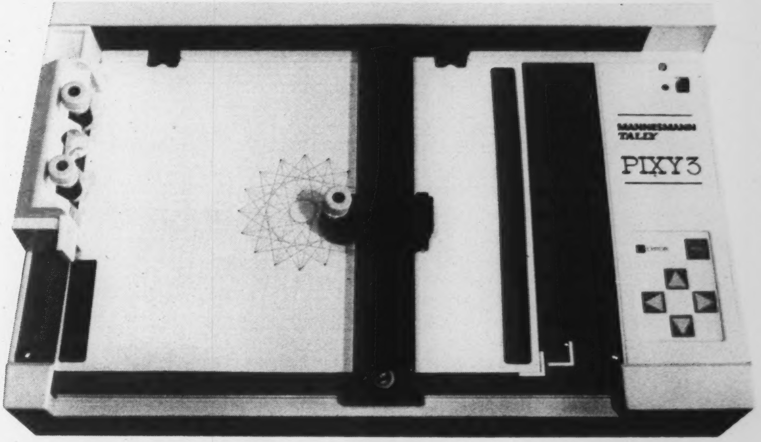
Pixy 3 Desktop Plotter by Mannesmann Tally



Pixy 3 plotter handles up to an 8 1/2" x 11" sheet of paper.

David H. Ahl

Have you been intrigued by the capabilities of a plotter but put off by the typical multi-thousand dollar prices? If so, you may want to consider the Pixy 1 and Pixy 3 plotters from Mannesmann Tally. Both cost under $1000, have a fair amount of built-in "intelligence," and produce more-than-adequate plots. The Pixy 3 has three pens, while the Pixy 1 has just one; we obtained a Pixy 3 and put it through its paces.

Compact Physical Package

The plotter is remarkably compact, measuring 17" x 10.5" x 4.7". It accepts an 8½" x 11" piece of paper on the flat plotting surface. However, the plotting area is smaller, 180mm (7.1") x 250mm (9.8"). If you have been resisting the metric system, this plotter will force you to reconsider—all the measurements and parameters must be specified in millimeters.

The paper is secured to the plotting surface by overhanging lips on the top (11" side) and upper part of the left of the sheet of paper. The right side and lower portion of the left side of the sheet are held down by flexible magnetic strips (see photo).

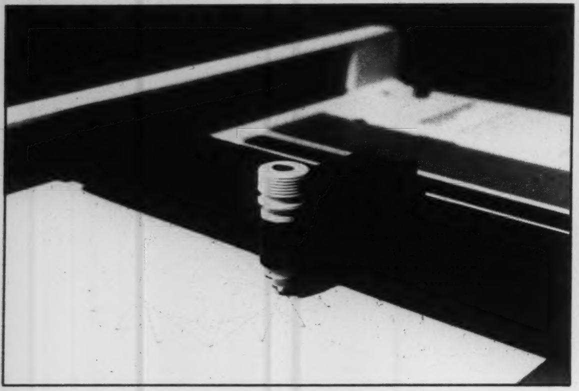
POWER
MANNESMANN TALLY
PIXY3
ERROR

Power switch, error indicator, and manual pen controls. Paper is held down by magnetic strips (left).

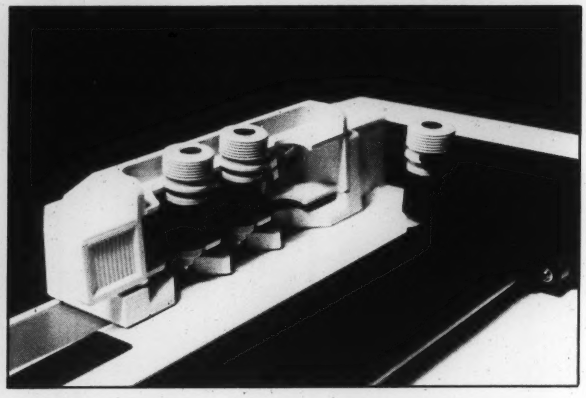
There are remarkably few controls. An on/off button switch is at the left rear. Four touch-sensitive directional controls and a pen up/pen down control for manual pen movement are at the left front. Turning the power switch on with one of the directional controls depressed activates one of three alternate functions: self-test, print mode 1 (plotter acts like a printer), and print mode 2 (plotter acts like a printer but does not respond to carriage returns—useful for checking plotter input data).

A red LED indicates an error condition. This occurs when a non-command character has been sent to the plotter or when the input data are in the wrong format.

Three types of pens are available for the Pixy plotters: fiber tip water base (for paper), fiber tip oil base (for acetate or overhead transparencies), and ceramic (for paper). Eight colors are available. The pens are held to the pen holder at the left of the plotting surface by a permanent magnet. The plotter head also has a magnet with which it picks up a pen.



Plotter head holds a pen by means of a small magnet.



Pixy 3 has three fiber or ceramic tip pens.

creative computing

HARDWARE PROFILE

Product: Pixy 1 and Pixy 3 plotters
Type: Flatbed, desktop plotter
Paper Size: Up to $8\frac{1}{2}'' \times 11''$
Pens: Pixy 1, one; Pixy 3, three
Fiber or ceramic tipped
Dimensions: $17'' \times 10.5'' \times 4.7''$
Characters: 96 ANSI, 47 Greek, 6 symbols
Interface: Parallel or RS-232 serial
Documentation: 48-page booklet; fair
Price: Pixy 1 $700 parallel; $785 serial
Pixy 3 $795 parallel; $880 serial
Summary: Excellent plotting capability, many built-in functions at a modest price.
Manufacturer:
Mannesmann Tally Corp.
8301 South 180th St.
Kent, WA 98031

The mechanism is amazingly simple. The plotter head moves vertically on a bar which moves horizontally. Upon power up, the head picks up pen 1, moves to the home (0,0) position, and awaits commands from the computer.

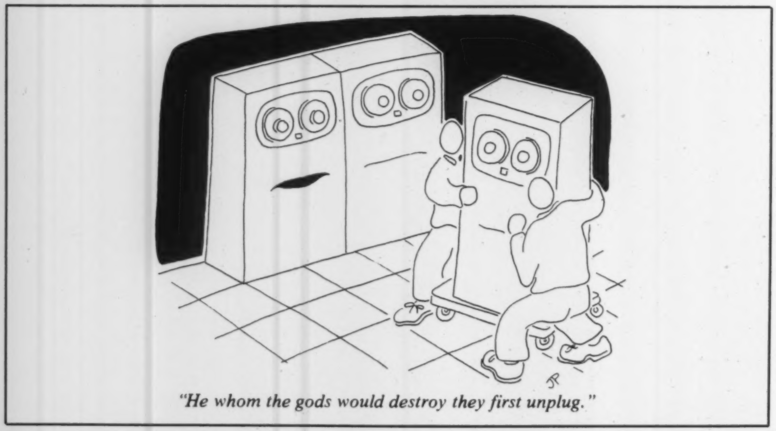
Repeatability (accuracy) with the same pen is within 0.3mm and with a second pen is within 0.4mm. Our plot of lines within a circle (Figure 1) verified this accuracy.

Easy Interfacing?

The Pixy plotters are normally equipped with an 8-bit parallel interface. This means that to hook up the plotter, you would have to disconnect your printer. We judge that most people would not want to do this, and, therefore, ordered our plotter with the optional factory-installed RS-232 interface.

The manual devotes 11 pages to describing the two interfaces—wiring the connector, timing diagrams, pinouts, and data protocols. It also states that "connection cables for all the major personal computers are available from Mannesmann Tally or your local dealer." Well, maybe. If not, a standard reversed RS-232 cable will work (Pin 2 to 3, 3 to 2, 4 to 5, 5 to 4, 6 to 20, 20 to 6).

> ***Once the plotter was interfaced and receiving the data sent by the computer, we found it had a rich and varied set of commands.***



"He whom the gods would destroy they first unplug."

But for us, that was just the beginning of the fun. Next, the DIP switch on the bottom must be set. It specifies baud rate (600, 1200, 2400), stop bits (1 or 2), parity, and data word length (7 or 8 bits). Next, your computer must be set to match in either hardware or software.

We went through all this and thought that all was OK, except that the plotter kept doing strange things. We set it to print out the incoming data and got pure hieroglyphics—well, maybe ASCII hieroglyphics. As it turned out, certain plotting commands must be enclosed in quotation marks and others not. This is not at all clear in the manual.

Another problem we encountered was that the plotter would not "handshake" correctly with our computer. According to the manual, when the 256-character buffer is full, an XOFF is transmitted to the computer, and when it is half empty (128 characters), an XON is transmitted. Maybe so, but our computer was having none of it. The computer kept the data flowing which led to the plotter buffer overflowing. When this occurred, the plotter sort of gulped, returned to the x or y origin (with the pen down), di-

I have the slippers. Could you get the paper?

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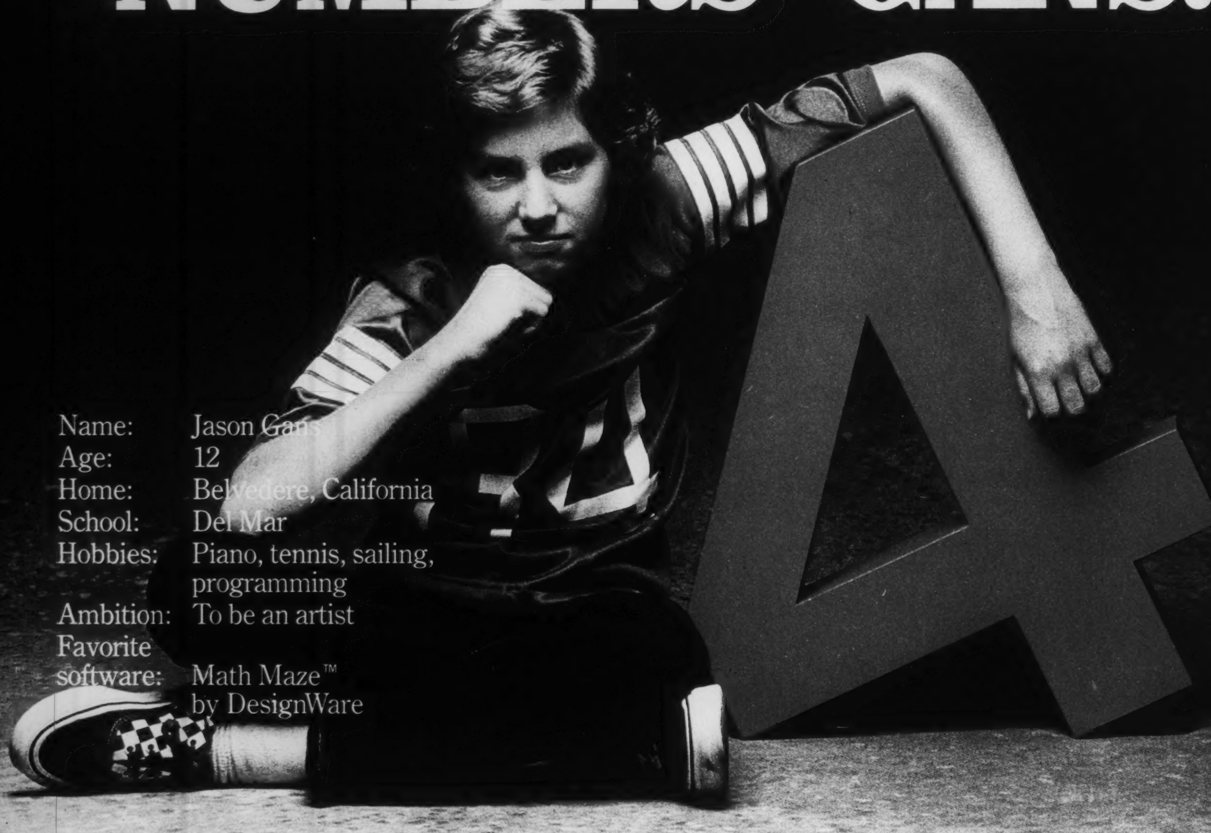

THEY CALL HIM "NUMBERS" GANS.

Name:	Jason Gans
Age:	12
Home:	Belvedere, California
School:	Del Mar
Hobbies:	Piano, tennis, sailing, programming
Ambition:	To be an artist
Favorite software:	Math Maze™ by DesignWare

"*Math Maze* is neat because you do more than just add and subtract numbers all the time. You've got to find them first. And then get there before you get caught.

"It's got real good graphics. I can even change the background color. And make the math as challenging as I want.

"There's lots of mazes, too. But the best thing is, I can make up my own. So when my friends come over, I've always got something new."

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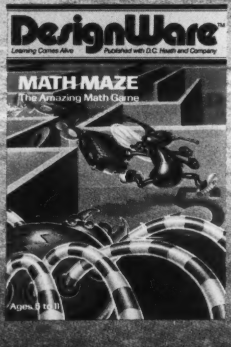
As Jason Gans says, "Hey—they don't call me 'Numbers' for nothing, you know!"



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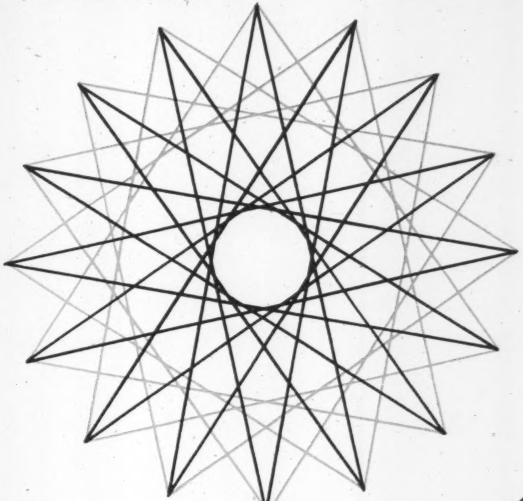


Figure 1. Lines in circle plot shows accuracy of Pixy 3 plotter.

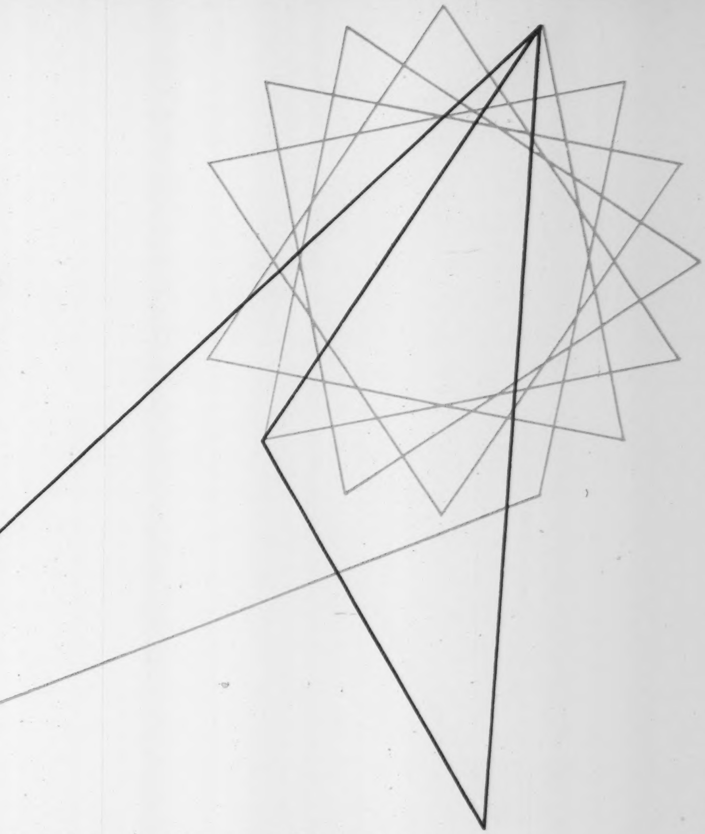


Figure 2. When the buffer is overloaded, the pen will momentarily return to one or both boundaries.

gested some new data, and started plotting from that point (see Figure 2).

Perhaps not the most elegant solution to this problem, but one that worked for us, was to set the slowest baud rate (600), and put an occasional delay loop in our plotting programs. Line 80 in Listing 2 is an example of such a delay loop.

Plotting Commands

Once the plotter was interfaced and receiving the data sent by the computer, we found it had a rich and varied set of commands.

For doing line graphs, the Pixy can produce nine types of line: solid, dashed, long-short dash, dash-double dot, etc. Moreover, the pitch (distance between successive line segments) can be varied over a wide range (1 mm to 25.5mm; 10mm is standard). As might be expected, the more complex line patterns cannot be differentiated with pitches under 10mm.

As mentioned earlier, the plotter surface is 180 × 250mm. Coordinates within this area are specified ~~in 0.1mm~~ increments. In other words, the live plotting area varies from x=0 to 2500 and y=0 to 1800. There is no provision for resetting the origin; 0,0 is always at the lower left.

Within this area, the most used commands will be M (move with pen up) and D (draw with pen down). These commands must be sent in the format:

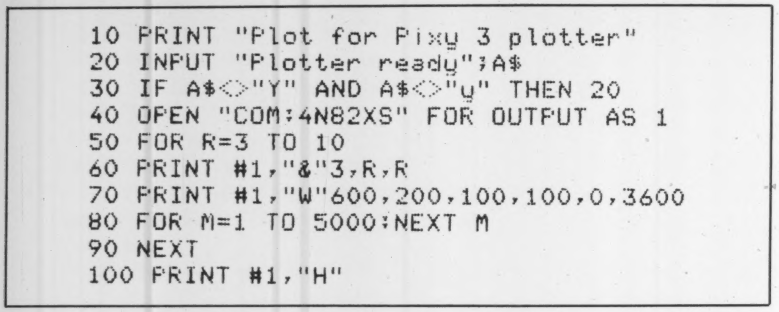
LPRINT #1, "M" 100,300
LPRINT #1, "D" 255,782

There are also two relative move and relative draw commands. These move the pen from the current position for the relative displacement specified by the x and y arguments in the command. For example, if the pen is at 100,200, and the relative move command "R" 25,50 is sent, the pen will move to 125, 250.

Two exceptionally powerful commands are the ones to produce circles and curves. Both of these can be specified with either absolute coordinates or relative movement. The circle command can produce circles, arcs, and spirals. Listing 1 is a simple program using the relative circle command (line 60) to

```
10 PRINT 'Plot for Plxy 3 plotter'
20 INPUT 'Plotter ready';A$
30 IF A$<>'Y' AND A$<>'y' THEN 20
40 OPEN 'COM:4N82XN' FOR OUTPUT AS 1
50 PRINT #1,'M'400,300
60 PRINT #1,']'200,0,0,7200
70 PRINT #1,'H'
```

Listing 1. Program produces spiral pattern in Figure 3. Listing was done on the plotter, but took nearly five minutes.



```
10 PRINT "Plot for Pixy 3 plotter"
20 INPUT "Plotter ready";A$
30 IF A$<>"Y" AND A$<>"y" THEN 20
40 OPEN "COM:4N82XS" FOR OUTPUT AS 1
50 FOR R=3 TO 10
60 PRINT #1,"&"3,R,R
70 PRINT #1,"W"600,200,100,100,0,3600
80 FOR M=1 TO 5000:NEXT M
90 NEXT
100 PRINT #1,"H"
```

Listing 2. Program produces eight circles. Scale factor is set in line 60 and circle is drawn in line 70.

draw a spiral (see Figure 3).

A "factor" command can change the plotting magnification or scale factor in the x and/or y axis. Coupled with the circle command, it allows ellipses to be drawn. Listing 2 is an example of the use of the factor command (line 60) with the absolute circle command (line 70) to produce a series of ellipses (see Figure 4).

The curve command draws a smooth curve through a set of three or more points specified as parameters. Both open and closed curves can be drawn.

For producing line and bar graphs, the Pixy has several useful commands. The axis command draws x and y axes with hash marks at specified intervals. The grid command draws series of lines parallel to either or both axes. Points on line graphs can be differentiated with 15 different special marks specified by the mark command. The marks can be drawn in any of 15 sizes from 0.7mm high to 10.5mm high.

As with the marks, 96 ANSI characters, 47 Greek letters, and 6 mathematical symbols can be drawn in any of 15 sizes. Unfortunately, letters and symbols in the smallest two sizes (0.7mm and 1.4mm high) are barely legible. From the third size on, there is no problem (see Figure 5).

A font command selects any of ten international character sets. Well, actually not an entire character set; 11 letters and symbols are changed for various countries.

All characters and symbols can be printed in four directions: 0, 90, 180, and 270 degrees. There is no provision for printing in other directions.

The documentation falls far short of the excellence of the product itself.

As mentioned earlier, if the up directional key is held down when the plotter is turned on, the print mode will activate. This uses character size 3 (2.1mm high) and produces reasonably legible listings. As it is extremely slow, you would not want to use this mode for long program listings or lists of data. For example, the seven lines of Listing 1 took nearly five minutes to draw on the plotter.

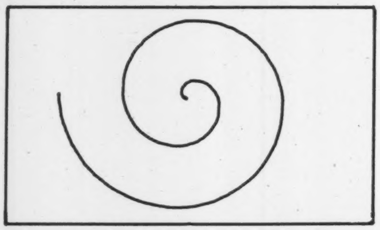


Figure 3. Spiral can be drawn with just one command (see Listing 1).

While we are on the subject of speed, we should mention that any of ten pen speeds can be set by the program for multiple step plots. The default value is the slowest speed, probably because it gives the most accurate and detailed lines. The fastest speed is useful for debugging plotting programs, as the plot will be correctly drawn but with a few occasional skips or uneven lines. However, if the steps are reasonably short, the faster speeds are perfectly satisfactory.

Documentation

As we have observed with so many other products, the documentation falls far short of the excellence of the product itself. Furnished with the plotter is a 48-page Operator's Manual. The first seven pages are devoted to nomenclature, operating notes, loading of paper and pens, and the self-test.

As mentioned earlier, 11 pages describe interfacing in a thorough, but highly technical way.

Three pages list the input data codes, two pages list the plotter specifications, two pages describe error procedures, one describes maintenance and cleaning, and one lists available accessories.

The balance of the manual, 20 pages, provides descriptions of the plotting commands, examples, and notes about their use. This in no sense is a tutorial; rather, it is simply a reference section with a few examples (often incomplete) from which you must figure things out on your own.

The Final Line

The Pixy 1 and Pixy 3 plotters provide excellent plotting capability at a modest price. If you do not need plots larger than 8½" x 11", can get along with one or three colors, and are willing to devote a fair chunk of time to experimentation, these plotters would be an excellent choice. We are disappointed in the documentation, but the essential information is there. You will just need patience and experimentation to get it out. END

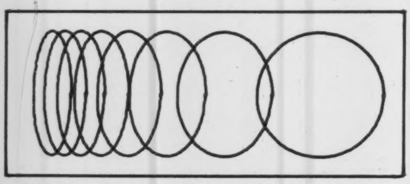


Figure 4. Eight circles with horizontal scale halved for each successive one (see Listing 2).

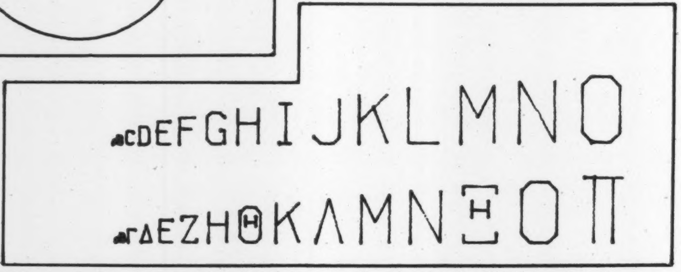


Figure 5. Roman or Greek letters can be drawn in 15 sizes. Smallest two sizes are practically illegible.

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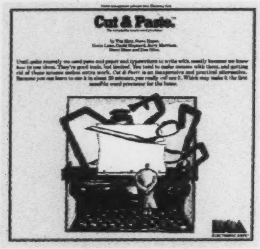

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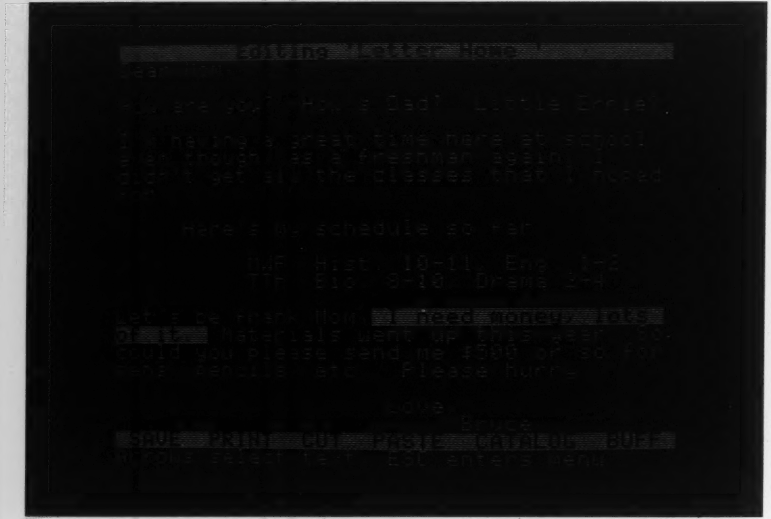

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THE MEN WHO MADE CUT & PASTE. *The Linotype machine pictured here was the 19th century's most important contribution to word processing technology. It let typesetters compose and rearrange text in the form of metal castings. The importance of Cut & Paste, of course, must await the judgment of history. Nevertheless, the seven men who developed it look confident here. Standing left to right, they are: Norm Lane, Steve Shaw, David Maynard, Dan Silva, Steve Hayes and Jerry Morrison. Seated at the console is Tim Mott, whose idea this was in the first place.*

people who have in common a very lucid philosophy of design.

Computers and the programs they run are tools, they believe. Tools are never noticed unless they are bad tools. When they're good, they become, in effect, invisible. And if you want to make a good tool—an invisible tool—you'd best study the way people use the tools they already have.

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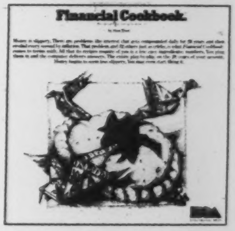

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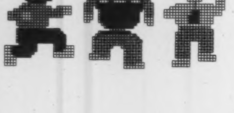

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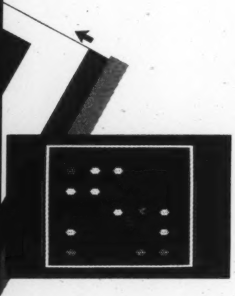

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Cooking With Percom

A Recipe For TI Disk Substitution

Joe Devlin

In today's troubled times we are all looking for inexpensive ways to stretch our computer dollars. One of the best ways is to substitute less expensive but nutritionally identical ingredients for expensive name brand ingredients.

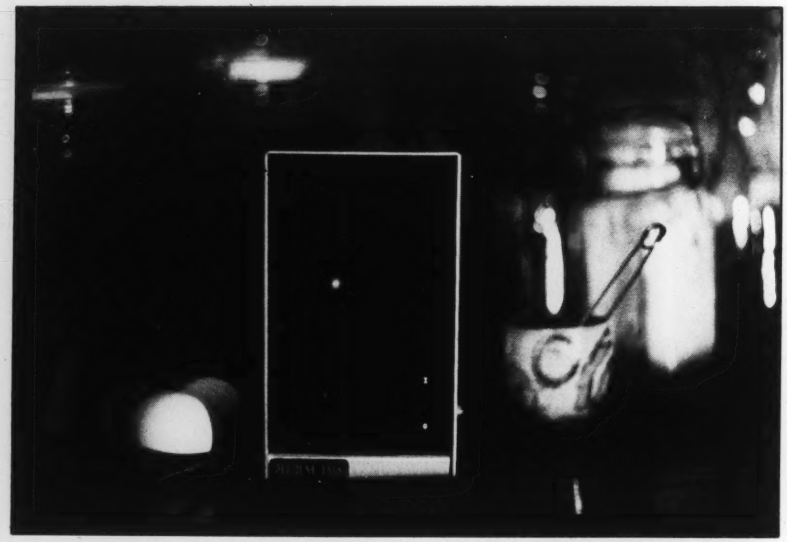
Any TI 99/4A owner who has tried to buy a disk drive for his computer knows that not only does it cost a few bucks to buy genuine TI, but that TI drive takes up a great deal of counter space in the kitchen.

Thank heavens, TI has slashed prices for their tasty disk drives. The current sale includes an expansion system disk drive, a disk controller card, the peripheral expansion box to plug the drive into, and a 32K memory expansion card, all bundled into a $550 disk drive memory system. This is quite a bargain when compared to the $1200 price this combination cost previously, but the smart shopper can save even more.

Disk drives are rather like food processors.

Percom offers a single density drive that plugs into the 99/4A computer for $349.99. Like the TI disk drive memory system, the Percom Data TX-99 drive takes single sided, 92K, 5.25" floppy disks. Just plug the Percom drive into the side of the computer with the cable included and the Percom is ready for action. You do not need the bulky expansion box the TI drive requires.

Disk drives are rather like food processors. You can do without them, but they do make your life easier, and sometimes the results are more aesthetically pleasing as well.



Disk Advantages

Among the advantages offered by disk drives are:

- Disks provide random access to data. This means that the computer does not have to read through every bit of information on disk to find what it needs. The computer must search through an entire cassette tape until it finds (or finds it cannot find) the information it is looking for. A disk provides the computer with a table of contents that lets it know instantly whether a particular program or data file exists and where to find it. Random access to data means that programs and data load much faster from disk than they would from cassette.
- Disks are more reliable and seem to lose data less frequently than do cassettes.
- A disk can hold much more information than a cassette. Therefore, those who wish to set up intricate data files will find disks more convenient to use than cassettes.
- The disk directory keeps track of what is on the disk for both the cook and his computer. If you tend to lose track of which program is saved on which cassette, the disk cataloguing feature will be of immeasurable aid.

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Documentation: Two no-frills manuals included, neither written with beginners in mind.

Price: $349.99

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Chromasette

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Percom, continued...

metal enclosure, and comes complete with a controller cartridge. To use the drive, just plug the controller cartridge into the front of the computer, connect the drive to the side of the computer using the cabling included and sit back and whip up some disk delights.

The back of the drive even has an expansion port for an add-on Percom drive when it becomes available. I have used the drive with a variety of disks and have found it reliable and nimble.

Documentation

The Percom comes with two no-frills manuals, one for the drive and one for the controller cartridge. Beginning disk chefs will find it difficult to learn to cook with these two books. Both books provide bare bones information served up with few garnishes. There is no tutorial or glossary to explain the vocabulary of disk usage. The beginner might want to search out some more general introduction.

In any case, the beginner will probably have to alternate between the two manuals, delving first into one, and then the other manual when the going gets rough. I suggest that you start with the first two chapters of the disk manual and then move on to chapter three of the disk manager manual for an explanation of the basic functions.

If you have developed a taste for disk storage you may want to add the Percom TX-99 drive to your shopping list. Once you get by the limitations of the manuals, I trust you will find it a worthwhile addition to your computer diet. Bon apetit. ▪

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2. *Wire components according to schematic diagram.*
3. *Plug in and turn on.*
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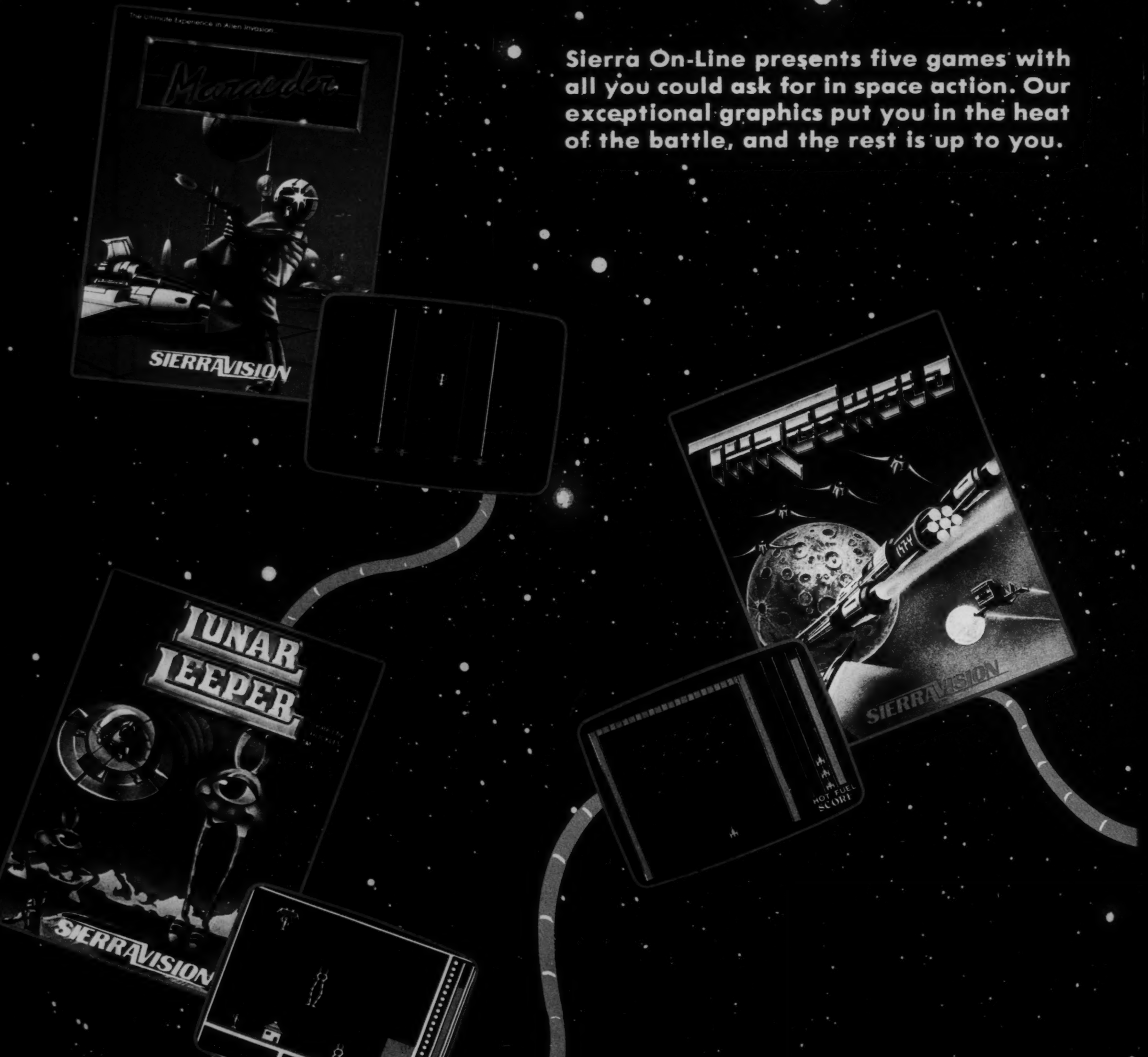
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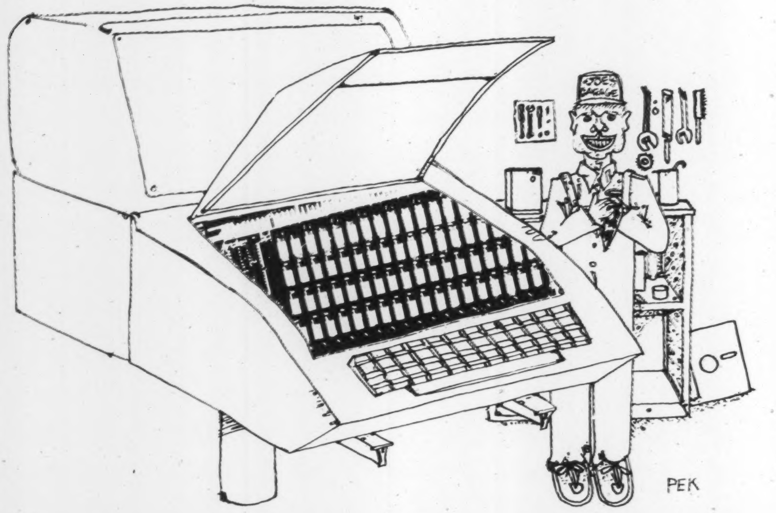
Apple Mechanic

A Programmer's Program

Paul Bonner



My first thought in attempting to review *Apple Mechanic* is that Bert Kersey and Jack Cassidy (known professionally as the Beagle Brothers) are a pair of lunatics. On a single disk selling for less than $30 they include a disk utility program, an excellent shape table editor, and a pair of hi-res text generators. Then they throw in a half-dozen useful little utility programs, and a Tip Book and PEEKS and POKES chart filled with information worth almost any price to anyone interested in Applesoft programming. Finally, as if all that weren't crazy enough, everything on the disk is listable and unprotected. They even encourage you to modify your programs to incorporate the routines on the *Apple Mechanic* disk.

My next thought is that all these features make *Apple Mechanic* very difficult to review. It is even difficult to classify. Let's call it a utility disk for want of a better word, and examine its features one at a time, beginning with the routines devoted to the shape tables.

creative computing

SOFTWARE PROFILE

Name: Apple Mechanic
Type: Utility
System: Apple
Format: Disk
Summary: Excellent shape table, hi-res text, and disk maintenance utilities; an excellent buy
Price: $29.50
Manufacturer:
Beagle Bros Micro Software
4315 Sierra Vista
San Diego, CA 92103

Paul Bonner, 327 Sterling Pl., Brooklyn, NY 11238.

Shape Editor

The program for creating shape tables is called Shape Editor. The tables it creates may contain up to twelve 48 × 63 point shapes. Once you have loaded the sample table included on the disk or a table that you have created, the entire table is displayed on the hi-res screen.

When you enter the command to edit a shape, the display changes so that you see the shape to be edited displayed twice—once in its actual size on the right side of the screen, and a second time enlarged three times in a plotting grid on the left side of the screen.

Plotting is done using the left and right arrows, the A and Z keys, and the spacebar. You can choose to have the shape you have selected pre-plotted or imprinted on the screen, either of which gives you a design to follow in changing the shape.

However, only the plotting you do while in the editing mode is entered into the final shape table. This can be rather tedious, because you must redraw the entire shape even if you want to make only a small change in it, but it does allow you to draw a shape without thinking about efficiency and then trace over an imprinted-image of the shape to draw it more efficiently.

Shape Analyzer

A useful companion to Shape Editor is the Shape Analyzer utility. Once you have created a shape table, you can use the Shape Analyzer to experiment with DRAWing and XDRAWing any shape in the table on different color backgrounds.

You can also view the selected shape in any degree of rotation or in any scale, and move the shape up-and-down or across the screen. Shape Analyzer also lets you analyze shapes vector-by-vector, which is helpful when you want to find a way to draw a shape more efficiently.

The documentation for Shape Editor and Shape Analyzer, and indeed for ev-

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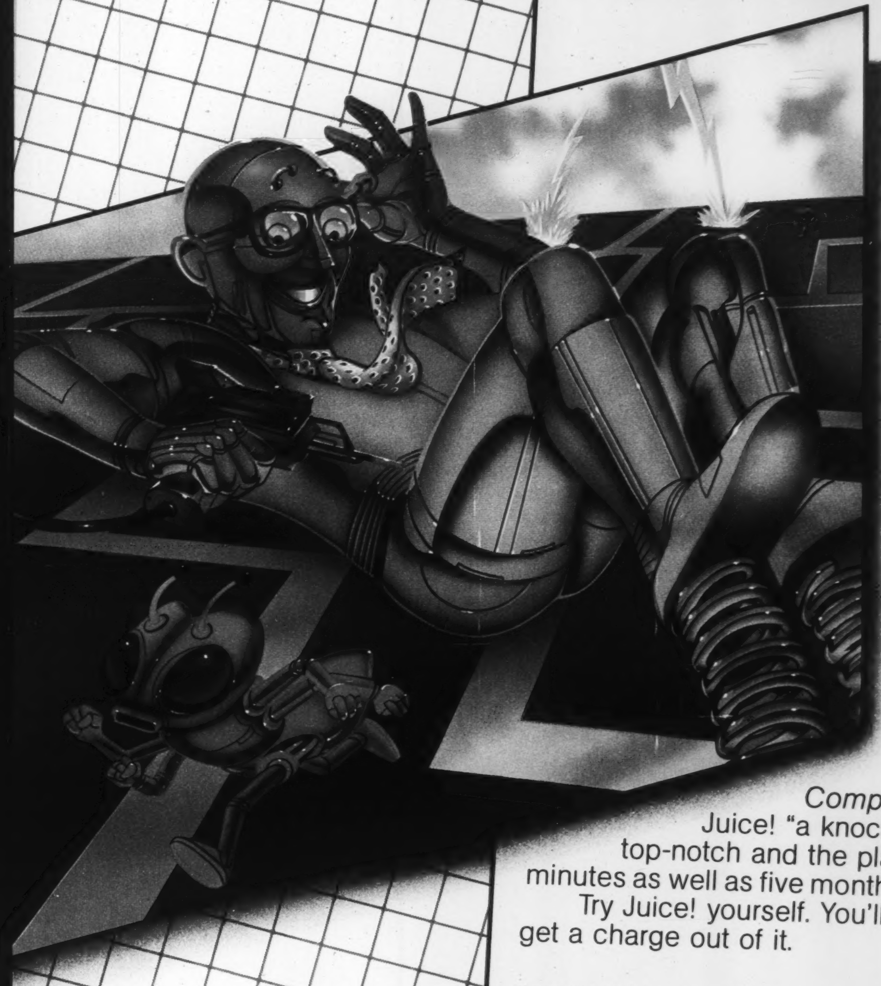

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ery program on the disk, is excellent. You get clear and precise instructions on how to use the shape tables created with these programs, including instructions for rudimentary animation.

Most of the commands for the programs on the disk require only a single keystroke. A key chart that identifies the commands for each program is included in the *Apple Mechanic* package.

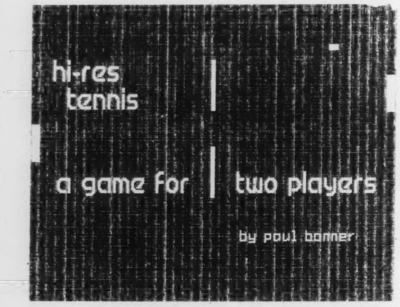
The authors have also included several "Hi-Res Manipulations," which tell you how to draw on one hi-res page while viewing another and how to do instant switching between the two hi-res pages and instant color-fills of either page. The disk also includes a pair of text programs that automatically move the contents of one hi-res page to the other.

When you add up these programs, you don't have a complete graphics package. What you do have is an assortment of valuable tools waiting for you to put them to use. Using the Shape Editor to create shape tables is much easier than analyzing the shape vectors bit-by-bit and converting them to hexadecimal code. (Although, if you want to learn to enter shape tables that way, the *Apple Mechanic* manual includes three pages of information telling you how to do it.)

Unfortunately, you still have to have some artistic sense to create interesting shapes. In my case, that made the Shape Editor somewhat disappointing. Still, the first time I used it I was able to create the necessary shapes for a two-player tennis game I was writing. They weren't exactly the quality of the monsters in *Ultima,* but they were much better than anything I could have drawn otherwise.

Hi-Res Text

The next group of routines on the *Apple Mechanic* disk is designed to create and display hi-res text. Included on the disk are six ready-to-use character fonts, each containing 95 characters. Two of these are small fonts containing characters with a maximum size of 7 × 8 points, and the others are large fonts containing characters of up to 14 × 16 points. All six fonts contain a complete set of both upper- and lowercase characters. No special hardware is required to use the lowercase characters.



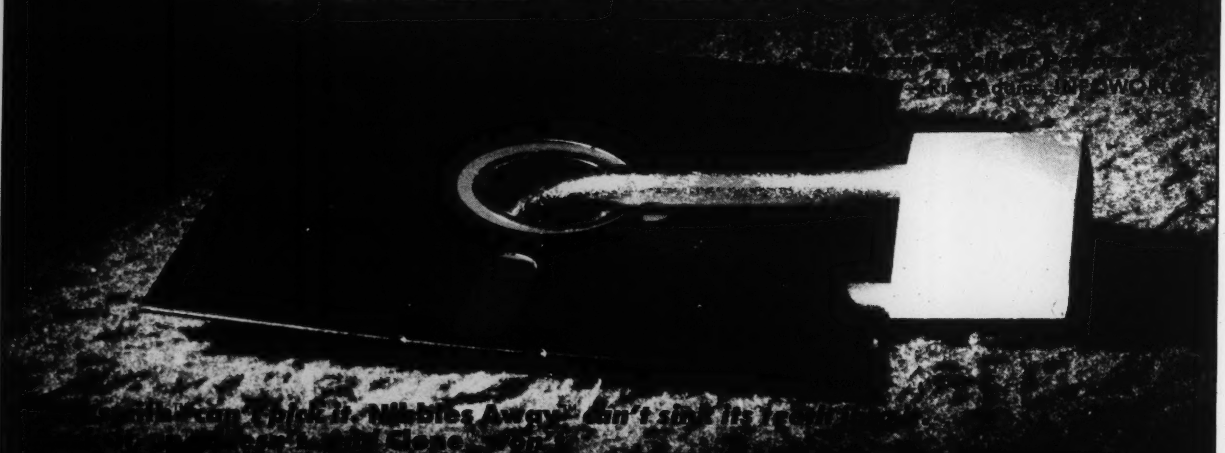
This hi-res picture incorporates some very simple shapes created with Shape Editor and hi-res text generated with Xtyper.

The fonts used by *Apple Mechanic* are shape fonts, meaning that they are designed and used like shape tables. The characters can be drawn in any color, and can be XDRAWn so that they contrast with the background color on the screen.

One disadvantage of shape fonts is that they take up more disk space than other fonts (about 18 sectors for large fonts compared to five sectors for some of the fonts found on Apple's DOS Tool Kit). The only other disadvantage of which I am aware is that neither the character fonts nor the shape tables created with *Apple Mechanic* are compatible with those used by most other programs.

Font Editor

The Font Editor program allows you to modify any of the fonts on the disk and to create entirely new fonts. The operation of this program is almost exactly



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like that of the Shape Editor. It is relatively easy and quite satisfying to create an entirely new character set with this program. In addition, it can be used to create shape tables containing more shapes than are allowed in tables created with the Shape Editor program.

The *Apple Mechanic* disk also contains a Font Splitter utility, a routine that allows you to eliminate unwanted characters from a font to save disk space.

Xtyper

Having created a character set, you need a way to use it. The *Apple Mechanic* disk contains two programs for that purpose. The first, called Xtyper lets you enter hi-res text directly onto page one of the hi-res screen. You can use up to three fonts at once and can load other fonts at any time.

Xtyper lets you enter hi-res text directly onto page one of the hi-res screen.

Before beginning to enter text, you are given the option of clearing the hi-res screen or loading an existing hi-res picture to which you want to add text. You then begin entering text on the screen, using the ESCAPE key to toggle back and forth between upper- and lowercase.

Changing the color of the type and changing to another of the fonts in memory are both simple two-keypress functions. When you have finished, you can return to the main menu and save the hi-

---

All in the Family: Beagle Bros Micro Software

Robert Engberg

I walk up the cement steps to the Kersey home and get ready to knock. Next to the doorbell I see a little sign:

PRESS BUTTON
2 Rings = Doorbell
1 Ring = Trap Door

The first time I saw that notice I rang twice, just to be sure. Sharon greets me today. Since the Kerseys are neighbors there are no formalities to my entrance. Sophie the Beagle trots up to see if I belong.

Behind the couch I see boxes of computer disks ready for the UPS man. "We ship out everyday," says Sharon, who controls the business end of the San Diego-based Beagle Bros Micro Software. "Business has been pretty good lately," she adds with a twinkle in her eye that suggests the company's success amazes even the company.

Bert and Sharon Kersey sold over 6000 floppy disks last month. "Maybe we should say '200 disks a day,' " Bert adds; "it helps give a better idea of the volume." Sharon adds, "When we tell people how much we sell, they don't always know we sell at 40% of retail. Eighty-five percent of our sales are to wholesale houses; only 15% or so are mail order."

Yes, sales *have* been pretty good. The company experienced 2000% growth during the last two years.

I ask if Sophie is the namesake of the company. "We tried to think of a name that people would remember. Every other software company was Data-this or Soft-that," Bert tells me. "We were driving home from San Felipe one day, and I recalled Walt Disney's Beagle Boys, those guys in striped suits who were forever trying to get into Uncle Scrooge's vault. We eventually hit upon Beagle Bros."

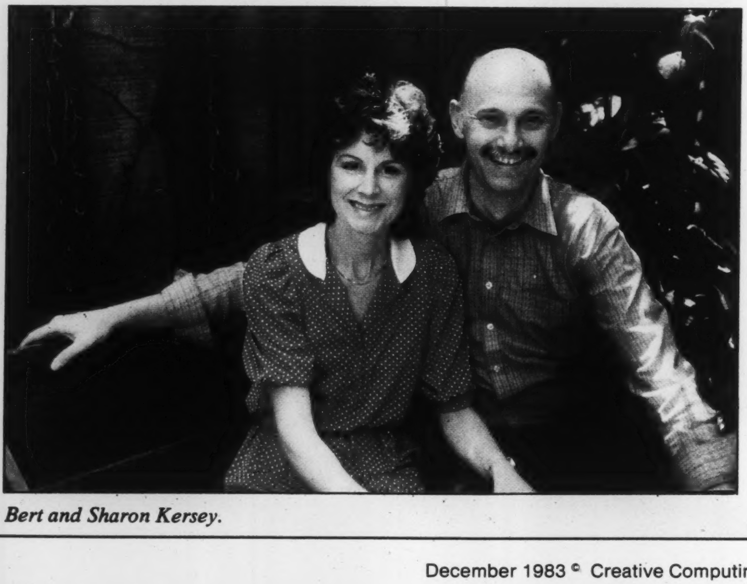
Who hasn't heard of *DOS Boss, Alpha Plot, Utility City,* and *Apple Mechanic?* Over 500,000 Apple computer owners have, or will have, and perhaps a quarter of them will buy a Beagle Bros disk this year.

Four of the disks have appeared on the top ten national sales list for home/hobby programs; several times four disks were ranked among the first ten *during the same month.* Most of them have been programs to help programmers program. Someone suggested that Bert's programs make Apples perform like Ferraris and can make a Mario Andretti out of you.

Bert writes his programs in Applesoft ("No time to learn machine language") but there is pressure for him to expand, to convert his programs for Ataris, Pets, IBMs, and TRS-80s. He has even been asked to translate his Tip Books into German and French. Already his disks are sold in Australia, New Zealand, Canada, England, and Spain.

In The Beginning

Bert literally fell into the software business three years ago. At the time he was 37 years old, a bored and successful graphic artist working out of his home office; he "pumped out" mail order ads, billboards, logos, brochures. He even designed a scoreboard display: "You know, when the Chargers scored, the lights would flash. There were 12,000 lightbulbs which flashed nine times a second. They were controlled by a computer, which then I knew nothing about and cared little for."



Bert and Sharon Kersey.

Robert Engberg, 4268 Sierra Vista, San Diego, CA 92103.

res page under any name that you like, thus enabling you to load and view it in other programs.

Hi-Writer

The second program for using the hi-res character sets is called Hi-Writer. By itself, Hi-Writer does nothing. It is meant to be used as a subroutine (consisting of lines 50-500) in your own programs.

Among the options available with Hi-Writer are mixed upper- and lowercase, a choice of any background color, automatic centering of lines, and inverse text. You can also rotate text 90, 180, or 270 degrees, allowing you to print lines upside-down or sideways. There is no provision in Hi-Writer for non-destructive animation using the second hi-res page, but since the program is listable it probably would not be difficult to modify it to include that feature.

It is unfair to compare Xtyper and Hi-Writer, since they serve different purposes. Xtyper is very good for labeling static hi-res images, while Hi-Writer creates dynamic images. But I think Hi-Writer is the more useful of the two. It doesn't take up much memory and adds only 10 disk sectors to the length of a program, while Xtyper requires 34 sectors for each hi-res page it saves.

Also, since Hi-Writer acts as a subroutine, the rest of your progam can do anything you desire. Thus, it is possible to have purple hi-res cows created with Shape Editor zooming around the screen while Hi-Writer generates text describing each cow's milk production.

Byte Zap

The last major program included on the disk is Byte Zap. It has little or nothing to do with the other programs on the

---

He made "Big Move #1," quit the graphics business, and bought a TRS-80. It broke so many times during the first three weeks he got his money back. Later he was persuaded to buy one of the new 16K integer Basic Apples.

The Apple became his work though it remains hard to distinguish between the Kerseys' work and their play. Sharon once told me, "If it isn't fun we won't do it." While perhaps not literally true, it is true enough; who else in the microcomputer world puts a program called Naked City on a disk and then prevents the user from running it?

We tried to think of a name that people would remember.

During that first year, Bert taught his Apple such useful tricks as spelling Sharon backwards and drawing blue cows in lo-res graphics. He also wrote some games. The first was called Text-Train and consisted of a little train composed of letters, which the player moved about and tried to connect, as would an engineer at the switching yard.

Executive Suite

Originally Bert worked in the dining room and the couple ate their meals on the kitchen table. The Kerseys recently added an upstairs office with enough space for Bert's two Apples II+'s (he still has his first although it has been upgraded to 48K with Applesoft in ROM), a new IIe, Epson and daisy-wheel printers, a typesetting machine, and Sharon's desk. The couple spends more hours of the day in that office than they do out.

There is never any doubt about the time. Behind Bert's workspace hang three large industrial-type clocks, each showing accurately the time for San Diego, Fresno, and Seattle.

A graph Bert keeps to track sales hangs by the staircase; it went off the chart in November '82, and I joke that he will have to cut a hole in his roof if business keeps up. He politely laughs and shows me the door leading to an anteroom where he keeps the photostat camera and a dark room.

A nicely framed Apple poster graces another wall, and tamper-proof windows fill the east and southern walls, letting in the summer breezes and winter sun. It is a pleasant room (important since the two spend 12-hour work days there) but already crowded. Disks are everywhere. "Disk City" Bert calls it.

There are as many reasons for the success of Beagle Bros as there are people who inquire about it. Bert thinks it is because of his determination not to work for anyone else. The pair are the sole staff (if you don't count Sophie the watchdog) except for some teenage relatives who stuff bags on Sunday afternoons. "They work hard and it gives them good experience," Sharon says, "We don't want other employees. Don't want to be slowed down by someone else's coffee breaks. I know some people don't think it's good for a husband-wife team to work together, but . . . well, it has worked. We still like each other."

Bert adds one more reason for the company's success, one less philosophical: "In that first ad, I promised something free . . . a chart of Apple commands. Instead of saying 'Buy our wonderful games' my headline read 'Free Apple Tip Book and Command Chart.' The small print said 'with game purchase.' " Beagle Bros is now on their fourth Tip Book and umpteenth printing of the free chart.

Looking Ahead

What's in store for BB? "Better software." A computer literacy guide for teachers and parents is planned this winter along with more utilities. Beyond that Bert doesn't know. "Things change so fast. I don't have a five-year plan. Yesterday some guy called up to complain about *Fast-DOS* (a disk to speed up the Apple DOS); that disk is six months old—obsolete. I sent him a copy of *Pronto DOS.* I don't know . . . Things change so fast." Last February an interviewer from National Public Radio asked Bert why he doesn't have a corporation and a lawyer. "I just don't like talking to people like that." And how long, he was asked, can *that* go on? "til 3:30."

Bert talks to lawyers more now. Since the interview, Beagle Bros has incorporated and there is even a corporate Jaguar in the driveway. Bert bought it on one of the rare days he allowed himself out of the house.

Sharon adds "It might be nice to get a motorhome, park beneath some pine tree, let Bert program and"—she points to the piles of disks and orders spread throughout the room—"spend some time away from all this." But even as she speaks I notice Bert doesn't add any more to the plan. He might do it (the pair did vacation for a *few* days at Lake Shasta last summer) but Beagle Bros is more than their business. To the Kerseys it is family and it is growing up fast.

Originally Bert worked in the dining room and the couple ate their meals on the kitchen table.

disk, but it can prove quite useful in its own right, especially if you have ever screamed "Oh no!" after hitting RETURN and seeing the disk drive light come on.

Byte Zap allows you to examine and change the contents of a disk sector-by-sector. Thus, it is possible to restore an accidentally deleted file or repair a blown Volume Table of Contents.

Byte Zap displays the contents of each location in the sector being examined in any one of five formats: hexadecimal, decimal, ASCII, ASCII with flashing characters changed to inverse, or catalog—a special mixed hex and ASCII format used for viewing the catalog sectors. You can switch back-and-forth between formats instantly.

Depending on how well you understand Apple DOS, using Byte Zap can have entertaining, life-saving, or disastrous effects. The entertainment value lies in changing Apple DOS commands and error messages, or in changing a Level-2 thief on your *Wizardry* disk to a Level-96 ninja.

The lifesaving value comes from the ability to restore an accidentally deleted file or to recover files from a disk with a bad DOS or a blown sector.

The disastrous effects of Byte Zap are, unfortunately, inherent in any program that changes the contents of a disk sector. It is quite possible to make a fatal error that will render a file unreadable. If you are changing the DOS, you can even blow the entire disk. The risks increase further if you try to alter a sector on a copy-protected disk. Fortunately, the authors of Byte Zap have included numerous warnings to back-up your disks, and the program always asks if you are sure you know what you are doing before it actually writes anything to disk.

That about covers the major programs on the *Apple Mechanic* disk. I should make some mention, though, of the Tip Book and the PEEKs and POKEs Chart. The Tip Book, which makes up the first 19 pages of the manual, is filled with listings of short subroutines and observations about quirks in Applesoft or the monitor. Some of these—like the program to convert Arabic numbers to Roman numbers—have rather limited value. Others, however—like a print-using subroutine and an ONERR subroutine which lists the line in which an error occurred and points to the offending statement in multiple-statement lines—are worth their weight in gold.

The PEEKs and POKEs Chart is an incredibly useful list of monitor subroutines and the memory locations of all kinds of wonderful data. Having been weaned on Applesoft, it gives me great joy to fill my programs with lines that CALL this and POKE that. The monitor subroutines listed on the PEEKs and POKEs Chart have much faster execution times than their corresponding Applesoft commands.

Summary

I grow more enthusiastic about *Apple Mechanic* each time I work with it. However, the very thing that I like about the disk keeps me from recommending it without reservation. That is, that none of the programs on *Apple Mechanic* is designed for users who want to boot a disk and then sit back and let it do all the work. They are written for programmers who want a product that they can expand upon, modify, and incorporate into their own programs. For that use, the programs on *Apple Mechanic* are excellently written and documented.

Thus, I recommend *Apple Mechanic* to programmers and tinkerers who are interested in graphics, hi-res text, or disk storage, and who want programs that serve as both tools and teachers in those areas.

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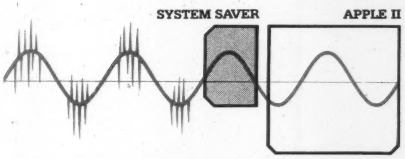

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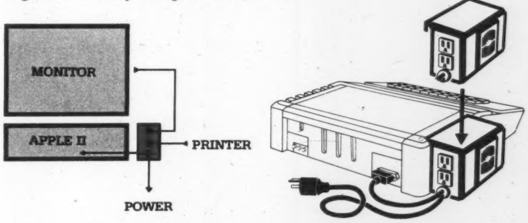

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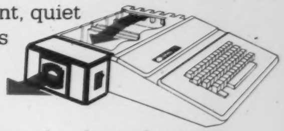

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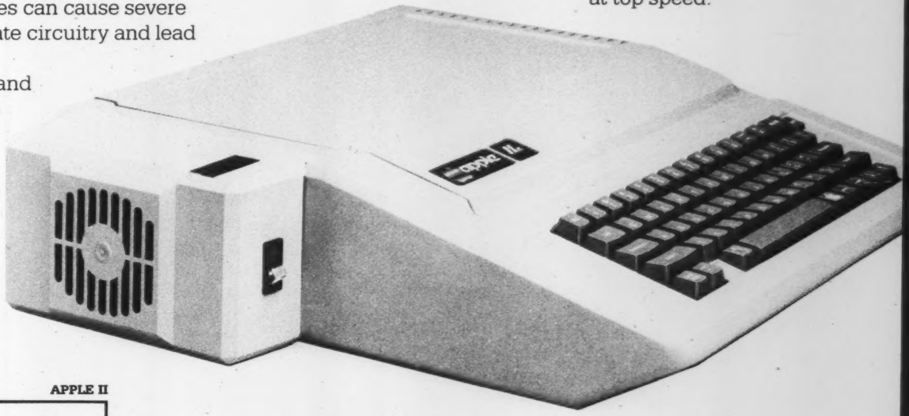

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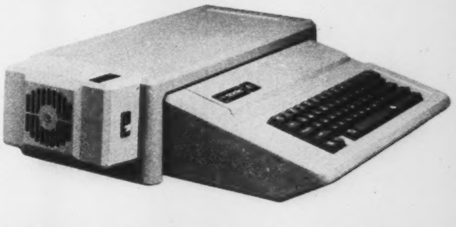

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Now you can easily share data among nine programs on your IBM PC.

Memory/Shift

Dan Robinson

Memory/Shift is one of those simple, why-didn't-I-think-of-that ideas that has the potential to make an impact on microcomputing like a meteor on the moon. The program uses the memory capacity of the IBM PC to hold as many as nine programs at the same time and pass data among them. It turns your software into a word processing/spread sheet/database management/and-anything-else super program.

Memory/Shift partitions the PC memory and operates each segment as if it were a separate computer. Each chamber can hold a program and you can jump from one to another and back again. If you wish, you may take data with you by marking it on the screen and then inserting it in another segment just as if it came from the keyboard.

Columns of *VisiCalc* numbers, for example, can be inserted in *WordStar* documents; or you can move to a Basic program for some fast calculations without disrupting your accounting system. You can put a program like *dBaseII* in one partition and a training program for it in another for quick and easy learning. A communications program can be kept on standby in one segment, ready to go on-line at any time and to pass data to or from an active program.

creative computing

SOFTWARE PROFILE

Name: Memory/Shift
Author: Jonathan Moore
Type: Integration program
System: IBM PC
Format: Disk
Performance: Very good
Ease of Use: Good
Documentation: Good
Price: $99
Summary: Unique program of its kind.
Overall Mark: Good
Manufacturer:
North American Business Systems
642 Office Parkway
St. Louis, MO 63141

The hair-tearing that comes from a DISK FULL message after a long work session is gone with *Memory/Shift.* You can jump to another partition and use DOS to look for space on another disk, kill files to make room for your data, or even format a new disk.

Dividing Memory

It might seem as though you would drop your baton trying to orchestrate as many as nine programs at a time, but *Memory/Shift* makes sure you will never miss a beat.

When you enter a partition, a message identifying the partition number and its size appears at the bottom of the display together with the logged-on drive for the segment. Each partition can have its own foreground, background, and border colors for easy recognition like a flag on a pole. If you have both the monochrome and color monitor cards installed and two displays, you can set up programs using both screens.

You can begin each partition with its own AUTOEXEC.BAT file or call a program from DOS. Each disk must have a volume ID label, and if the correct disk is not in the active drive you are prompted to insert it. Although you can override the prompt, the process keeps you from getting lost and messing up your files: you won't try to read your *WordStar* file from the *SuperCalc* disk or vice versa.

Each partition must be large enough to accommodate the program as if it were running on its own, complete with DOS. If you try to load a program which requires more than the memory which has been allocated to the partition, you are warned and the loading is aborted without crossing the boundary into another segment. Once each program is up and running in its partition, you can rotate from one segment to the next or jump directly to any one of them.

Moving Data

Being able to leave *WordStar* for a moment to look up something in *dBaseII,* check a number in *VisiCalc,* or go to DOS for a few chores is nice. But the real magic of *Memory/Shift* lies in being able to move data from one application program to another.

> ***It might seem as though you will drop your baton trying to orchestrate as many as nine programs at a time.***

When you want to copy something to another program, you simply mark the data on the screen, go to the program to receive it, and dump it wherever you wish. You mark blocks of data on the screen by using the Alternate and large + key on the right of the keyboard. A blinking cursor appears, together with

Dan Robinson, 1625 Higgins Way, Pacifica, CA 94044.

brief instructions to move the cursor to the upper left of your target data and mark it by striking the spacebar.

You then move the cursor to the lower right of the block to complete the marking. Your identified block is highlighted and *Memory/Shift* asks for the character used as a line terminator, such as a carriage return. You may then move to another segment and dump the block wherever you wish with the Alternate and - keys.

The data you mark can replace that in the *Memory/Shift* buffer or can be tacked onto it. As many as 3200 characters may be transferred at a time. Character blocks can be composed of an entire screen of data or portions of numerous screens. You can even mix sources from separate partitions.

I have crammed my IBM PC with 640K of RAM and like to divvy up the space with 320K for electronic disk, 64K each for print spooling, word processing, spreadsheet, and communications, and the rest for miscellaneous DOS chores.

Not every program can live happily ever after with Memory/Shift.

Memory/Shift has followed a keep-it-simple strategy, and its brief Help file may be called from any segment. It shows the partition and memory allocation and permits you to change screen colors for the segment. Like all of the *Memory/Shift* messages, it borrows only a bit of screen space and restores the screen when its job is done.

The standard CTL/ALT/DEL sequence will reboot only the current partition without affecting programs operating in other segments. There is a command for rebooting the entire computer, but *Memory/Shift* properly treats this as akin to a Freudian death wish and provides an are-you-sure-you-really-want-to-do-this prompt.

Custom Installation

Memory/Shift has a custom installation program which allows you to set the number of partitions and their sizes, their screen attributes, and whether disk label checking will be active. The installation program also allows you to redesignate the keys *Memory/Shift* uses to move from one partition to another, to mark, and to move data. You can override the settings when calling *Memory/Shift*, specifying the number and size of each partition.

Memory/Shift will work with DOS 1.1 or 2.0, but as a protected disk it can't be stored on a hard drive. Once the program has been fired up, the disk need no longer be in a drive. One backup copy may be obtained at a nominal charge.

Not every program can live happily ever after with *Memory/Shift*. Some programs which change the keyboard or disk service routines will cause *Memory/Shift* to hang or crash, so it is best to check out each program before beginning serious work.

But *Memory/Shift* will let you hold a handful of programs in your IBM at the same time, move freely from one to another, and take any data you like along with you.

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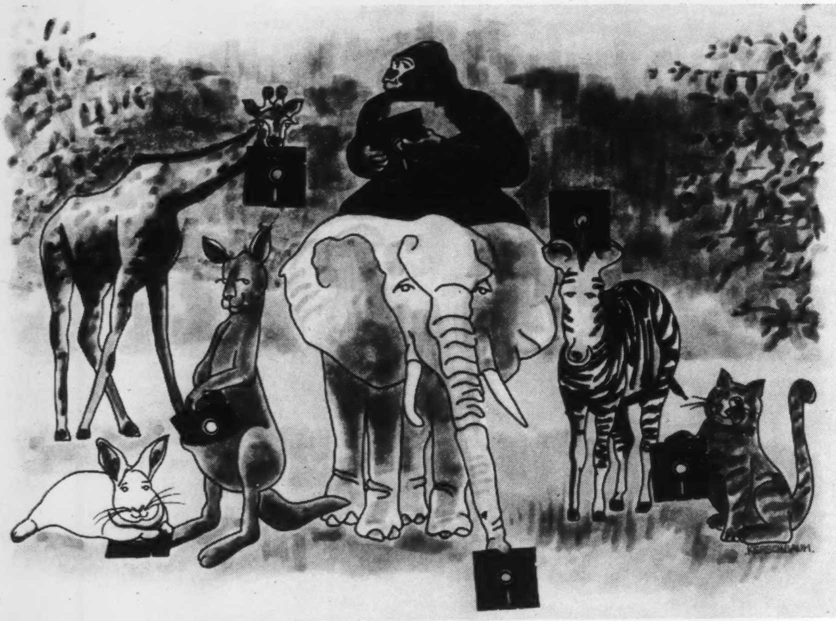

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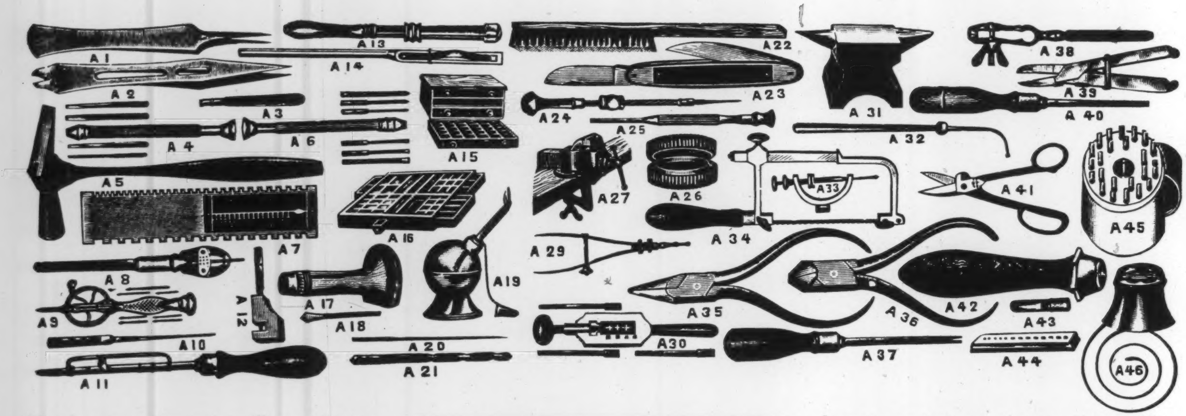
The Tool

A Program Generator cum Programming Utility

Terry Harmer



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Such are the claims of program generators and programming utilities. Some programming utilities (like the Apple renumber utility) are very simple. The more exotic ones will reduce a program in Basic to one in machine language (a compiler).

A program generator will write a program for you (usually in Basic). Simple program generators will write menus; sophisticated ones will write entire programs.

The Tool from High Technology Software Inc. is neither a program generator nor a programming utility. It is a bit of both. On the one hand it generates code, but not in Basic. On the other hand it does not work on your program, but is intimately connected to it. What *The Tool* really does is write machine language subroutines according to your specifications. These routines are accessed by an Applesoft Basic program that you write.

How Does It Work?

The Tool has three segments. The Screen Formatter creates screen formats and input fields, and allows complete error checking and input validation. The Database Manager allows you to create a database system customized for your own purposes which, in a very sophisticated manner stores, sorts, deletes, or modifies information on disk. It requires no knowledge of DOS to use. The Report Generator allows you to define the report titles, column headers (columns can be various widths), variables and how they print (you can print just part of a variable), and line spacing. *The Tool* formats and stores the report specifications, complete with print-time calculations, pagination, titles, and headers.

The Database Manager allows you to create a database system customized for your own purposes.

Each of these *Tool* functions is separate and distinct and may be used independently, but none will work without a program written in Applesoft.

Constructing a Tool System

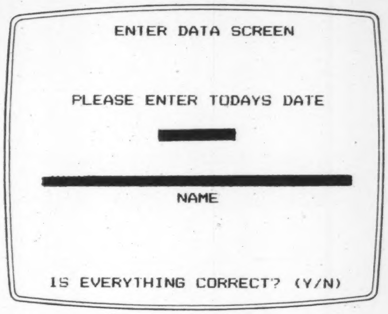
The Tool places very few restrictions on your programming; you can even use your own machine language routines in addition to those of *The Tool.* Access to *The Tool* is by means of commands from your Basic program to a *Tool* module called the Dispatcher. The Dispatcher relays your instructions to the run-time system, which in turn calls and manipulates the *Tool* modules that you have designed.

The Screen Formatter

Designing a screen with *The Tool* takes place in four steps:

- Designing the physical look of the screen both for labels and for input fields.
- Describing for *The Tool* what kind of characters can be entered into each field and then describing which particular characters will be acceptable (called *validating* the input).
- Telling *The Tool* what screens you want to use for this particular application (called *linking* the screens).

Terry Harmer, Box 846, Bellingham, WA 98227.



```
ENTER DATA SCREEN

PLEASE ENTER TODAYS DATE

NAME

IS EVERYTHING CORRECT? (Y/N)
```

Figure 1. A Tool screen the way the user would see it.

- Compiling the linked screens into machine language subroutines that can be accessed by the RTS, which in turn takes commands from a program written in Applesoft.

This process is very much like writing out the screen on a word processor. You have options for deleting, adding, inserting and moving text (and input or display fields). Figure 1 is an example of a *Tool* screen the way it would appear to a user of the final program.

Designing reports is similar to designing screens.

The Database Manager

The Tool can also handle your database needs. It is an ISAM database with all the records automatically stored and retrieved in key order. It uses a "virtual DOS" that is not compatible with Apple DOS but does allow much more data per disk. Don't worry about being compatible with Apple DOS; you can access the Apple DOS from within *The Tool*, so regular DOS functions are supported. The only requirement is that you include the volume number with each DOS command.

Defining The Database

You must define for *The Tool* what the sort key will be, choose which fields are to be included in the key, and decide how many characters of each field will be included. Your records will be stored and retrieved in that key order. There can be any combination of fields up to a maximum length of 62 characters.

The Database Manager allows you to add, delete, or modify records very simply. It keeps track of all the volumes (capacity 253 disks—up to 15 million records) pointers, records, and so forth. The only real constraint is that you must specify the volume number(s) when you are initializing the data disks, and you must be able to tell *The Tool* ahead of time the maximum number of records the database will contain.

creative computing

SOFTWARE PROFILE

Name: The Tool

Type: Programming Utility/generator

System: Apple II+, IIe

Format: Disk

Language: Machine

Performance: Good

Ease of Use: Fairly easy

Documentation: Good

Summary: A flexible package.

Price: $395

Manufacturer:
High Technology Software, Inc.
Box 14665
Oklahoma City, OK 73113

The Report Generator

Designing reports is similar to designing screens. You first must define for *The Tool* what the general format of the report will be. You are given a screen, and you define the report title, column headers, which fields will be in what columns, how much of each field will be printed, and various other information about line spacing between records and so forth. When this is done, you have finished formatting the report, at least in terms of its visual format.

Report Calculations

The report generation facilities include nine mathematical functions that can be performed on the various lines of your report. These include add, subtract, multiply, divide, and absolute value. You can use either variables or constants in these operations.

Cobol Pictures

A Cobol picture is used for formatting numeric output in your reports. It allows you to define what the number will look like, regardless of what the actual number is. For example, you can either print or suppress leading zeros. There are ten different functions which can be combined. The end result is that you can format your numbers any way you want without any complicated coding in Basic.

Are We Done Yet?

At this point we have linked and compiled the screens. We have merged the reports into one binary file. The database has been defined and created. Now to put them all together *The Tool* creates a Run Time System (RTS).

You tell *The Tool* whether this particular application will use the screen formatter, the report generator, or both. *The Tool* then creates the system that will use the screens and reports you have designed.

We now need to be able to tell the RTS when we want a particular screen or a particular report. This is done by means of the Dispatcher. The Dispatcher provides the link between your Basic program and the RTS. The Dispatcher responds to commands that are in your Basic program.

Some Simple Instructions

In its simplest form, the Basic program will have commands that are something like this:

```
90 & OPEN #1, "EXAMPLE,V1"
```

This opens the database part of the program. It gets the Database Manager ready to store information. The ampersand wakes up the RTS and signals that a dispatcher command is coming. The #1 is the information channel to that database (you can have up to nine databases active at the same time).

It is not intended for the casual programmer who may want to whip together a little mailing list once a year.

There are fourteen Dispatcher commands. These plus the ability to shift back and forth between your Basic program and the *Tool* modules yield an enormous flexibility. They also guarantee that what *The Tool* cannot (or isn't intended) to do, you can do with your Basic program.

Summary

There are many programs competing for your dollar. *The Tool* at $395 competes for quite a few of your dollars. People who do not write in machine language, or who do not know how the latest disk filing systems work, but who can figure our needed applications will find *The Tool* indispensable. It is not intended for the casual programmer who may want to whip together a little mailing list once a year. But those who have lots of programs they would like to write (and do not write code quickly) will find that *The Tool* will greatly increase their productivity.

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AND CHANGES MONTHLY

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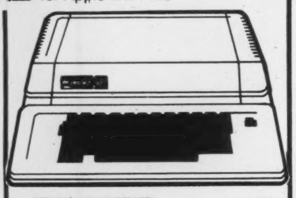

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★ **Saturn Systems**, RAM Card (II +)	32K	$ 249	$169
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Dow Jones, Market Analyzer		$ 350	$275
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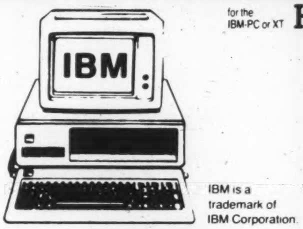

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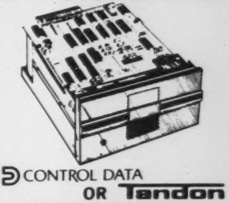

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CIRCLE 143 ON READER SERVICE CARD

Here's a fast, efficient, and inexpensive disk operating system for your Apple.

Diversi-DOS

Robin Raygor

Many of us have been painfully aware of the inefficiencies in Apple's DOS 3.3 for some time. Many very useful programs from *Apple Writer* to *VisiCalc* have seen us sitting idle (through no fault of their own) while we waited for information to be written to or read from disk.

We have watched with some anticipation, the development of various attempts to speed up DOS. These attempts have so far consisted primarily of partial fixes which speed up some DOS operations but not others. Enter Bill Basham's *Diversi-DOS.*

Performance

As far as I can tell, there is no major disk operation that this system does not speed up. I tested it against Apple DOS, and although the differences were not quite as great as those listed in DSR's advertising, they were still enough to make me sit up and take notice.

I used a 139-sector binary program to check BLOAD and BRUN times. For the rest of the times I used a 66-sector Applesoft program I wrote to manage multiple choice and true-false test items. This program uses a random access text file containing 150 test items each of which has a record length of 500 characters. The total length of the file is 230 sectors. As you can see in Table 1, *Diversi-DOS* read the file in 55.2 seconds, close to half the time it took Apple DOS. This was *without* using the call to an intrinsic subroutine which sets the record parameter and presumably allows you to read and write random access files even faster than this.

Some of the file operations were so fast I thought something was wrong. The most dramatic differences involved handling binary files. Anyone who has spent much time waiting for long binary game programs to load can probably get fairly excited about an operating system that handles binary files more than four times as fast as Apple DOS.

The spectacular performance of this product is almost eclipsed by DSR's unique marketing approach.

Table 1.

Operation	Apple DOS	Diversi-DOS
BLOAD	34.4	7.9
BSAVE	37.6	8.5
BRUN	35.1	8.6
LOAD	9.6	3.4
SAVE	15.3	5.8
RUN	11.7	4.5
READ	99.3	55.2
WRITE	101.9	61.0
VERIFY	3.1	3.1
DELETE	2.6	3.0
LOCK	2.5	2.5
UNLOCK	2.5	2.5
CATALOG	2.1	1.9

(time in seconds)

Marketing

The spectacular performance of this product is almost eclipsed by DSR's unique marketing approach. When you boot the master disk you are confronted with the novel message Please copy this disk and give it to everyone you know. This rather startling proclamation is followed by nine exclamation points to let you know they are serious.

The text goes on to explain that it is legal to copy the disk but to use *Diversi-DOS* requires that $25 be sent directly to DSR.

In a time of escalating piracy/protection techniques it is quite refreshing to see this kind of trust on the part of a software vendor. DSR claims that this method cuts distribution costs by over fifty percent, and, to their great satisfaction, people are actually sending in the money.

Other Goodies

As if the hot operating system weren't enough, DSR offers some very attractive accessories with *Diversi-DOS.* A type-ahead buffer allows you to type at full speed, even when the disk is spinning, and not lose any characters. This is extremely handy for dreary multiple file operations like renaming all the files on a disk.

An optional print buffer does the

Robin Raygor, 444 Maple Ln., St. Paul, MN 55112.

same thing on the output side by using the disk as a buffer to store text on its way to the printer. Also included is a DOS mover option which moves *Diversi-DOS* into a RAM card if available.

Documentation

Although *Diversi-DOS* comes with no manual in the traditional sense, ample documentation is contained in the menu and the extensive instructions on the disk. One menu option allows dumping the instructions to a printer. The instructions can also be converted to a standard text file so they can be edited and printed out in any format you like. The instructions are clear and accurate and go far beyond just explaining how to work *Diversi-DOS*.

Included are a custom printer driver for word processors, instructions for making *Diversi-DOS* work with Fid, Renumber, DOS Toolkit, 40-track drives, hard disks, etc. The instructions also cover setting up the new RESET vectors, installing *Diversi-DOS* on existing disks, and creating data disks with 32 extra sectors.

One menu option even finds the greeting program on protected disks and runs it for you. This works on any program using a normal DOS format and allows you to use *Diversi-DOS* with many commercial programs including *Screenwriter II* and many game programs.

Drawbacks

You have to be fairly picky to find fault with *Diversi-DOS*. I have tried everything I can think of to do with it, and it has performed flawlessly. The only drawback of any kind I could find is the lack of standard DOS error messages.

Many of the high speed operating systems for the Apple that are now becoming available have made room for their extra goodies by giving up the INIT command. *Diversi-DOS* supports all normal DOS commands by giving up the error messages. Instead, errors are reported by number.

Several other drawbacks surface when you use some of the accessory options that come on the *Diversi-DOS* master disk. The type-ahead buffer makes it impossible to PEEK at the keyboard strobe in the normal way to test for a keypress or tell the ASCII value of the key, although GET and INPUT work normally.

creative computing

SOFTWARE PROFILE

Name: Diversi-DOS
Author: Bill Basham
Type: Operating system
System: Apple II
Format: Disk
Language: Assembly
Summary: Amazing
Price: $30
Manufacturer:
DSR Inc.
5848 Crampton Ct.
Rockford, IL 61111

The print buffer which uses the disk for spooling also has problems. It disables the INIT and CHAIN commands and eliminates the functions of special printer cards, although in fairness, it is hard to imagine using these during spooling.

Not only are these drawbacks fairly minor, they can be avoided if necessary just by not using these options. Actually, the most serious drawback of *Diversi-DOS* is that it makes you impatient when operating the few programs that won't run under it.

Summary

Diversi-DOS really works. Rarely have I been this satisfied with a software product. Performance, documentation, and support are all superb. The author himself is available by phone every day from 3:00 to 5:00 p.m. to answer questions of registered users.

It seems likely that in the future software will come with *Diversi-DOS* or some similar fast operating system. Until then *Diversi-DOS* will be a valuable tool for anyone who has better things to do than sit and wait for the little red light to go out. END

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Xedit: An Editor for Basic

Alan Burnes

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So why buy a Basic editor when there is a perfectly good editor built right into your Model I or III. Read on to discover the answer.

creative computing

SOFTWARE PROFILE

Name: Xedit

Type: Full screen text editor

System: TRS-80 Models I and III

Format/Language: Cassette and disk

Performance: Excellent

Ease of Use: Good

Documentation: Excellent

Price: $29.95 cassette, $34.95 disk.

Summary: A must for programmers. Good value and a good package.

Overall Mark: Excellent

Manufacturer:
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P.O. Box 214
Rye, NY 10580

Editor Functions

Xedit is a full screen text editor. That means that a Basic program can be edited in blocks of twelve lines (one whole screen) rather than line-by-line. With user-controlled scrolling, the entire program is available for changes. You won't have to guess at a line number or range, list the program, and hope to catch the right part with BREAK or SHIFT-@ as you do with a line editor. You just scroll until the area you want appears, make your change, and move on.

Xedit also offers global search and replace so you can search for and change every occurrence of a specified string.

The actual editing technique is simple and easy to learn. You can move the cursor backward or forward through a line of text with the left and right arrows, and from line to line with the shifted up arrow and the ENTER key. Since the cursor is non-destructive you can see the entire Basic line, including your changes at all times.

The basic functions of delete characters, insert characters, and extend a line are also supported in *Xedit.* Insert mode in Xedit has a nice feature: SHIFT-@ plus a letter inserts one of 26 macro key definitions. For example, SHIFT-@-P causes the word PRINT to be inserted at the cursor location. These macro key definitions default to common function names such as PRINT, INPUT, FOR, and NEXT, or they can be redefined by the user to any six character strings.

Now we get into more flashy functions that allow you to edit your program as you would edit *Scripsit* text. For example, *Xedit* has line insert and delete and block move, copy, and delete. I find these functions extremely useful for copying subroutines, or adding a standard header of inputs, process, and outputs onto subroutines.

Xedit also offers global search and replace so you can search for and change every occurrence of a specified string to another string. With this function you can find a particular variable fast and change it throughout the program in one operation.

If you don't like the statement numbers in your program, you can let *Xedit* renumber the program for you.

I mentioned earlier that *Xedit* allows slow scroll forward or backward with

---

Alan Burnes, 312 Rosewood Terrace, Rochester, NY 14609.

the ENTER or SHIFT-up arrow. A fast page scroll, scroll to start of program, and scroll display to a specified line are also part of the editor.

Documentation

I think all the functionality mentioned above is reason enough to buy *Xedit*. When the quality of documentation is taken into account, however, *Xedit* becomes an even better buy.

Xedit comes with a 25-page manual that explains all the functions with examples, and a sample program to run the edit examples on. The manual tells you what you need to know to use the editor without excess verbiage. The techniques for backing up *Xedit* on a disk and changing the auto-repeat speed are appended to the manual.

Limitations

There are only two functions I would like to see that *Xedit* does not support: merge subroutines into a program from a disk file, and execute contents of a disk file which contains *Xedit* commands to make the same changes in multiple program revisions.

Conclusion

Although I had no trouble loading the program the first time, *Xedit* comes with a 30-day free replacement warranty in case the tape or disk fails to load. I have worked with it for over three months and have found no bugs yet, so I have no complaints.

If you do any more than cursory Basic editing and you want a full screen Basic editor that is easy to learn and use, doesn't waste your time, and has clear functional documentation, *Xedit* should be part of your programmer's toolkit. END

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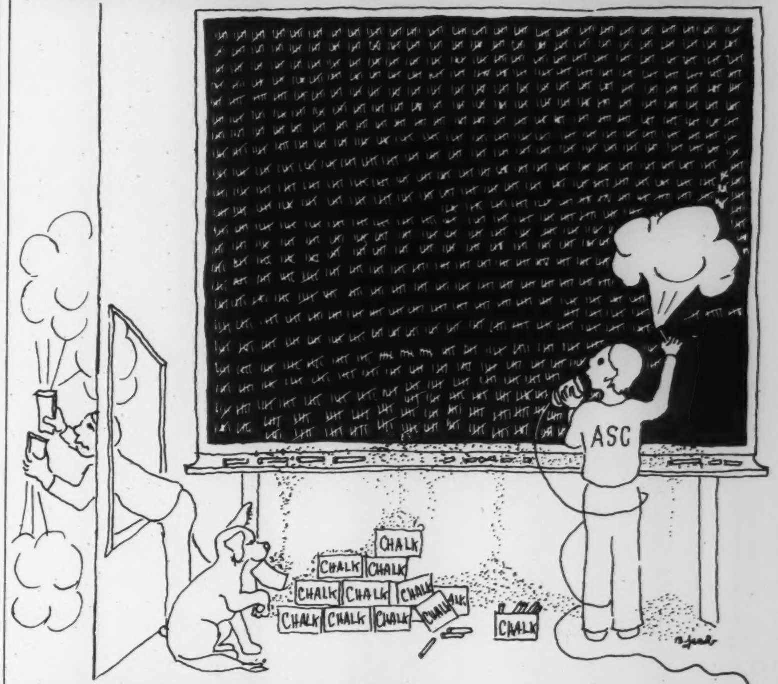

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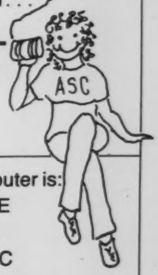

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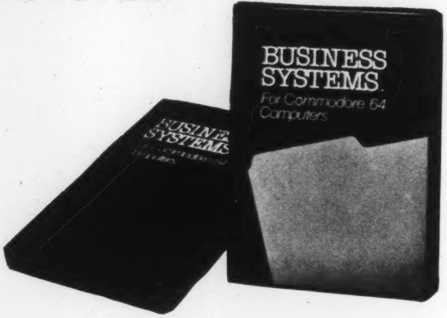

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CIRCLE 281 ON READER SERVICE CARD

Graphics and Music for the Color Computer

Joe Devlin

Semidraw

Semidraw is a sketching program that allows you to draw on the screen of your television or monitor. It is called *Semidraw* because it makes use of the Color Computer semi-graphics modes. Along with the advantages of text co-existent on the screen with graphics, the semi-graphics mode allows you to have up to 15 colors onscreen at one time, rather than the maximum of four available in other Color Computer graphic modes.

The problem with the semi-graphics mode is that it provides a rather strangely shaped pixel, one that is much longer than it is tall. The creators of *Semidraw* have evened out this monstrosity by creating a cursor that is relatively large, but symmetrical.

The program starts with a detailed semigraphics drawing lesson for the novice. If you prefer, you can skip this part and start with a blank screen or recall a previously saved image.

creative computing

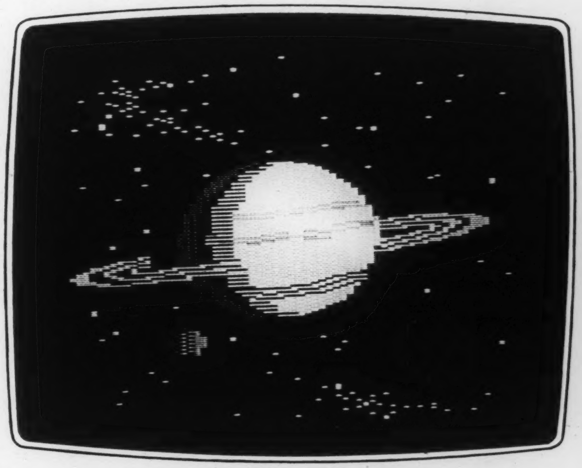
SOFTWARE PROFILE

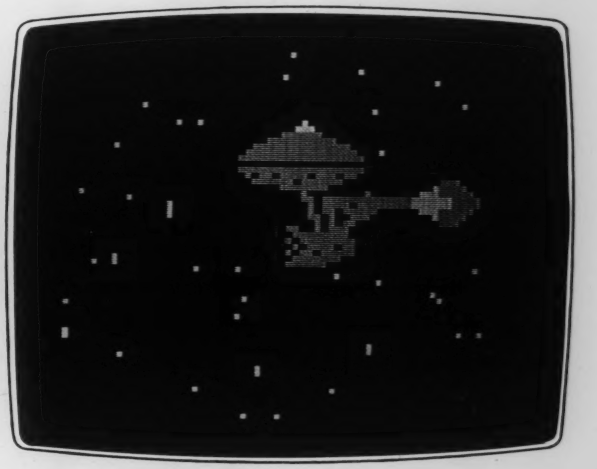
Name: Semidraw
Type: Graphics program
System: 32K TRS-80 Color Computer
Format: Disk or cassette
Language: Basic and machine language
Summary: More color and animation for the color computer.
Price: $21.95 cassette; $26.95 disk
Manufacturer:
Computerware
4403 Manchester Ave.
Encinitas, CA 92024

Semidraw can apply color to the screen wherever the cursor can be moved. The cursor is moved around the screen using either the right joystick or the arrow keys on the keyboard. To draw or set a dot simply press the joystick button or the @ key. The color of the cursor indicates the color of the dot you will set. You can change the color of the cursor with the left joystick or by pressing the C key and the number of the color you want.

Three Graphics Resolutions

There are three graphics resolutions to choose from. All three modes are 60 pixels across, but mode 8 is 64 pixels high, mode 12 is 96 pixels high, and mode 24 is 192 pixels high. Depending upon the graphics resolution you have chosen, you can create up to six different screens of drawings. These screens appear to be contiguous; if you move your cursor too far down, you end up on the next screen. This is nice for setting up animations or when you are so inspired





that just one screen cannot express the creativity you feel. You can sketch three pictures in mode 8, then change to mode 24, and all three pictures will appear on the screen at once, side by side.

Text With Graphics

The program allows the mixture of text with graphics, using the built-in character generator in the Color Computer. To enter the lettering mode, set the cursor where you want the text to begin, press the L key and type away. The resulting characters are green on a black background.

If you don't want to use black as the background color or if you want to erase an entire page, press the K key followed by the number of the color you wish the background to be.

Your creations can be saved to or recalled from tape or disk at any time. Once created, an image can be recalled, altered, and resaved in its altered form. This facility makes simple animation a snap. To change the pages of the screens, press the number key corresponding to the page you wish to view. To copy a page over, press the R key. You will be asked which pages you want copied and where you want them copied.

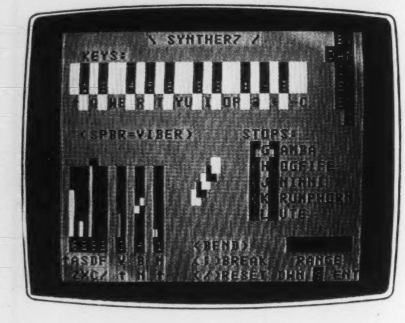
Semidraw *is a well designed package for the amateur artist.*

Simple animation effects may be achieved by pressing the P key. This causes the program to cycle through each available page. The speed of animation can be controlled with the right joystick.

A copy of your artwork can be dumped to your Radio Shack Line Printer VII or VIII or to a NEC 8023 or C. Itoh 8510. Press S and follow the prompts. The resulting picture will be printed sideways and will simulate different colors with differing dot patterns.

Because large parts of the program are written in Basic the program can be annoyingly slow. This is especially true during the animations, which are not particularly animated. Speed is also something of a problem just in moving the cursor across the screen and entering commands. Response to keyboard input is slow, and sometimes keystrokes are ignored—probably because they are missed.

The cassette or disk you buy includes several sample screens that can be displayed and altered to your specifications. I thought the animated rainbow was a bit too cute, but it does illustrate the animation potential of *Semidraw*.



Summary

In sum, *Semidraw* is a well designed package for the amateur artist. It can be used to simulate animation, although if you are planning to include animation in a game you are writing you will probably have to store the screens and then display them using your own software. Although parts of the program could use speeding up, overall the features and design of *Semidraw* provide a nice outlet for your creative urges.

Synther 7

I have a confession to make. I sing in the shower; I imitate instruments on my drive to work; and I got a kick out of playing with *Synther7*. *Synther7* is a real-time "music" synthesizer for the Radio Shack Color Computer. It is designed for the musical ignoramus like myself who nevertheless drums and hums when no one is listening.

Load the program and your initiation into the world of music begins. Bypass the offer of a detailed description of the workings of the package and the screen will be your guide to your instrument.

At the top of the screen is a series of black and white keys. Under the picture of the piano keyboard is a listing of the letters and numbers on the computer keyboard which correspond to musical notes. The top row on the keyboard corresponds to the black keys on a piano and the second row to the white.

Six bar graphs at the left of the screen indicate the options you have for shaping the sound of the notes played on your keyboard. A block of text in the lower center indicates your choice of musical instrument, and a horizontal bar on the lower right displays the pitch range of that instrument.

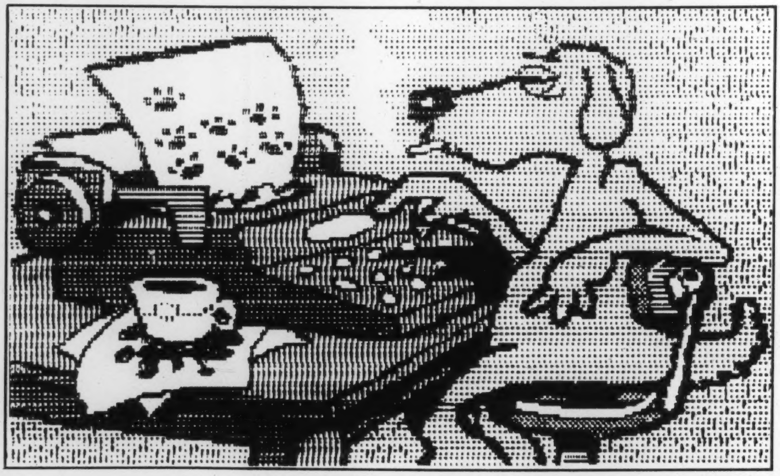
creative computing

SOFTWARE PROFILE

Name: Synther7
Type: Music Synthesizer
System: 32K TRS-80 Color Computer
Format: Disk or cassette
Language: Machine language
Summary: Unusual music and sound for the Color Computer.
Price: $21.95 cassette; $26.95 disk
Manufacturer:
Computerware
4403 Manchester Ave.
Encinitas, CA 92024

Five Instruments:

The five instruments from which the musician can choose are the gamba, hogfife, jninni, krumphorn, and lute. I am not sure how accurate the sound of most of these instruments is, partly because I am not sure how many of them exist in real life. Each instrument is accessed with a single keystroke.



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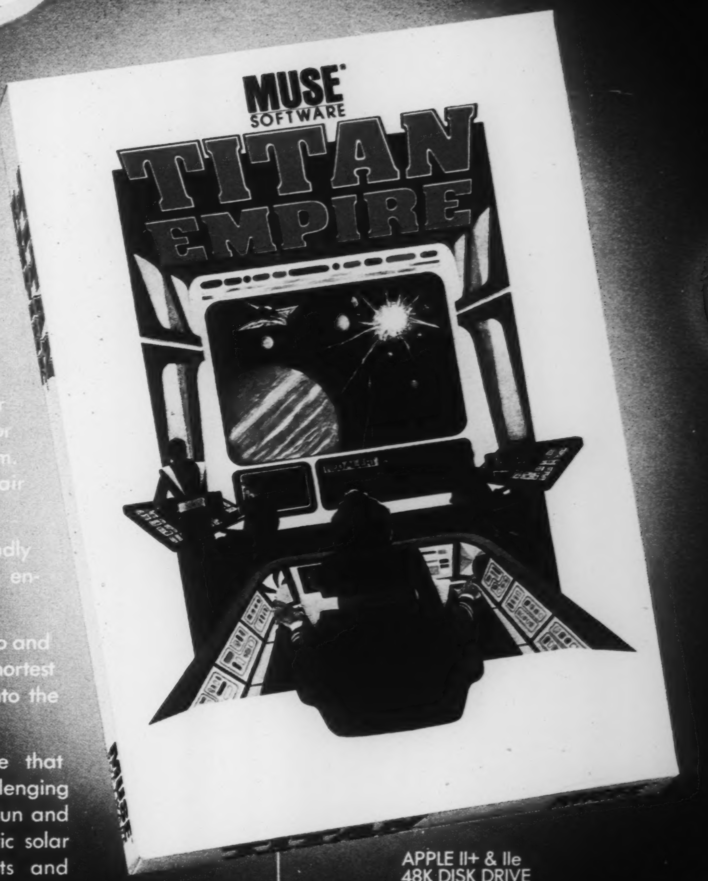

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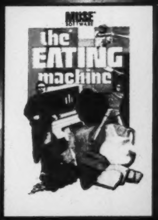

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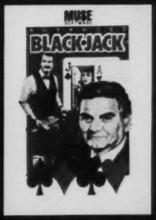

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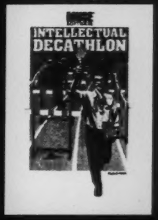

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Graphics and Music, continued...

Five more instruments, labeled simply alternate instruments, can be generated by hitting the / key. Each instrument is interesting in its own way.

The tonal range of each instrument is graphically represented at the lower right of the screen. Only two octaves of the total range can be accessed from the keyboard at any one time. You select which two octaves will play by pressing the up-arrow and K keys.

Feel Free To Experiment

Each instrument also has its own predefined character. You are as free to change the character of the notes as you are to change octave selection. Thus, notes can be made louder or softer, or shorter or longer, and twang can be added or taken away—all with the stroke of a few keys.

The attack of the notes, which is the fervor with which the note begins, can be adjusted. Notes can be set so they either decay or hold steady. Vibrato can be set to be pronounced or subtle. A set of six bar graphs on the lower left of the screen indicates how each note characteristic is currently set. There are many variables to play with. Feel free to experiment. An almost infinite range of effects is possible. With each graph element is a number which may be copied so that you can re-create interesting discoveries.

Synther7 *is not for the professional musician.*

Synther7 does have its shortcomings. The most serious is that it has only a single voice; only one note can be played at any one time. Although the music you play can be saved on cassette, it is the sound and not the coding that is being saved. This means that while you can play your creations back, you cannot insert them into other programs. Nor can you alter the nature of the music once it is recorded except by rerecording it from scratch.

Obviously, *Synther7* is not for the professional musician. But who cares if the music produced sounds more like a Looney Tune melody than the Boston symphony. *Synther7* is fun. *Synther7* requires no special external hardware. Music emanates from the speaker of your TV or monitor or from the speaker of your cassette recorder.

It's a shame you can't hear the Ode to *Synther7* I have been composing. I think it is the best thing I have done since the imitations of Elvis Presley imitating Bob Dylan I did last week in the shower. END

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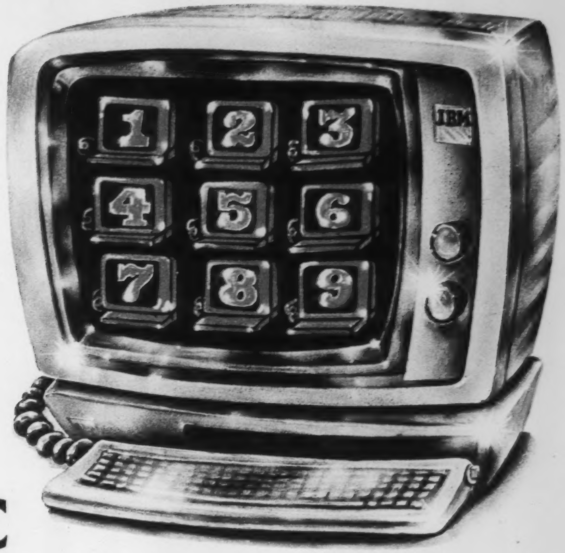

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Growing Up Literate

Part 2

Betsy Staples

Inconsistency, inaccuracy, poor documentation, poor controls, etc., etc. If you have been following our recent coverage of educational software for personal computers, you know that many of the packages currently competing for your educational software dollar are nothing more than high technology garbage. The editors of *Creative Computing* have even coined a new term to describe it: we call it swillware.

With so much swillware available, it is an overwhelming pleasure to review a series like Arcademic Skill Builders from Developmental Learning Materials. (No, that is not a typo; Arcademic is a contraction of arcade and academic which describes quite accurately the flavor of the series.)

The language arts series includes six packages: *Verb Viper, Word Man, Word Invasion, Spelling Wiz, Word Radar,* and *Word Master.* Each package includes a disk; a pile of high quality, reproducible worksheets; an abbreviated instruction sheet; and a large format, 8½" x 11", 28-page instruction manual which includes detailed directions for using the disk, the instructional rationale for the program, and step-by-step instructions for implementing "the Arcademic approach" in both classroom and home settings.

Documentation

Since there is a great deal of overlap in the manuals, and they are all of the same high quality, we will consider them all together.

Although written in educatorese, the manuals are basically pragmatic and easy-to-understand. The instructions for implementing the Arcademic approach—from setting aims to interpreting progress to setting new aims—are so complete and detailed that they should allay the fears of the most cyberphobic teacher and the least pedagogically inclined parent.

The abbreviated instruction sheet that is packaged in a plastic folder with each disk testifies to the amazing consistency in format among the six packages in the series. The keyboard controls are identical for all six games as are the commands to change options. After one play of one game, you have all the information you need to play any variation of any game in the series—what a welcome contrast to programs we have seen that lack consistency from one keystroke to the next.

Verb Viper offers a moderate degree of challenge in an entertaining, easy-to-understand format.

Now let's take a look at the individual packages.

Verb Viper

Verb Viper, as its name implies, offers practice in noun-verb agreement. On the lefthand side of the screen you see a benign-looking dragon (not a viper). Under his head is printed a noun with modifiers as appropriate. From the righthand side of the screen emerges a series of verbs headed for the dragon's mouth.

As a verb that "matches" the noun approaches the mouth, you must press the spacebar to flick his tongue and consume the verb. Verbs that do not match are let go, and they fly off the top of the screen. If you attempt to eat a nonmatching verb or overlook a matching one, you hear a sound that indicates you have made a mistake, and a "miss" appears in a box at the bottom of the screen. For each correct match you make, you score a point in the "hit" box.

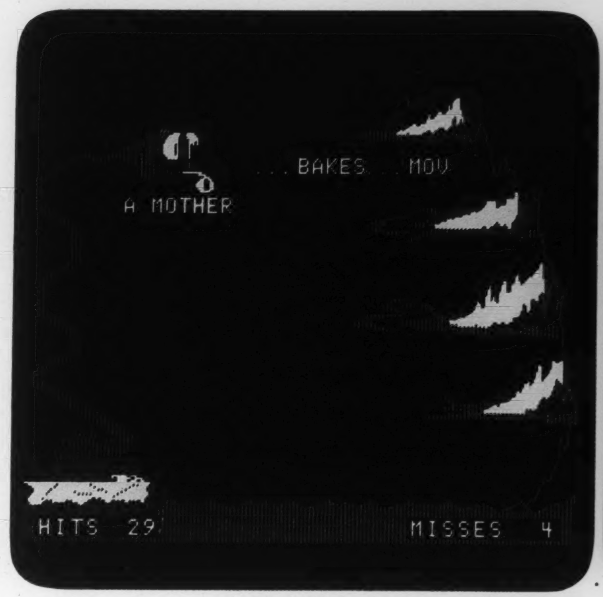
Every few seconds, the noun changes, and you must shift mental gears from, for example, A BOX to THREE BEARS without missing a verb.

At the end of the allotted time period

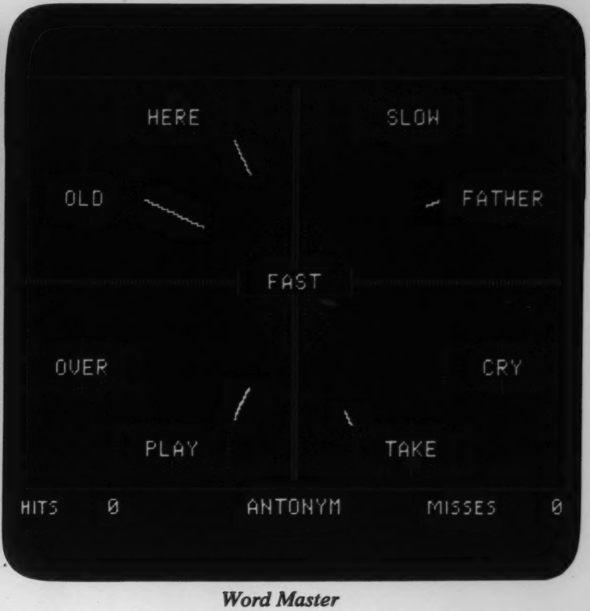
creative computing

SOFTWARE PROFILE

Name: Verb Viper
Type: Educational game
System: 48K Apple
Format: Disk
Summary: Practice in noun-verb agreement.
Price: $44
Manufacturer:
Developmental Learning Materials
P.O. Box 4000
Allen, TX 75002



Verb Viper



Word Master

(you can set the duration of each session from the option menu) the screen changes to a display of your score for the current round, and a reminder of your highest and lowest number of hits and misses. This scoring procedure is the same for all games in the series. The challenge is to increase your hits and decrease your misses in the next round.

From the option menu you can specify a speed from 1 to 9 which controls the rate at which the words travel across the screen. You also choose one of four content options, which include "to be" and "have" verbs, singular and plural present tense action verbs, regular and irregular past tense verbs, and past participles with auxiliary verbs. The difficulty level—also selectable from the menu—offers four choices, as well.

Verb Viper offers a moderate degree of challenge in an entertaining, easy-to-understand format.

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SOFTWARE PROFILE

Name: Word Master
Type: Educational game
System: 48K Apple
Format: Disk
Summary: Challenging practice with synonyms, antonyms, and homonyms.
Price: $44
Manufacturer:
Developmental Learning Materials
P.O. Box 4000
Allen, TX 75002

Word Master

The display for *Word Master* divides the screen into quarters, each of which contains two words. In the center is another word around which rotates a pointer. At the bottom of the screen, in addition to your score in hits and misses, is printed ANTONYM, SYNONYM, or HOMONYM.

Your job is to find the word that is an antonym, synonym, or homonym for the word in the center, move the pointer so it points to the appropriate word, and fire. You use the option menu to specify whether you want only antonyms, only synonyms, only homonyms, or a mixture of the three.

Each series of eight words is timed, as is the entire round. If you fail to "hit" all eight words in the time allotted, the center portion of the screen disintegrates before the next series of words appears, costing you valuable time. There are four difficulty levels.

Word Master offers a reasonable challenge for almost anyone when played with only one kind of relationship. When played with a mixture of all three relationships, it took the starch out of our most verbal adult playtesters.

Word Radar

Word Radar is the program we found the least entertaining in the Arcademic Series. It is not bad; it is just not as much fun as the other games in the series.

The display in *Word Radar* is again divided into quarters. Each quarter contains one, two, or three rectangles behind each of which is a word. The counter moves clockwise around the center as it ticks away your time. At the bottom of the screen a word appears in another rectangle.

Your objective is to match the word at the bottom of the screen with the word behind one of the rectangles. To do this, you press the arrow keys to move the cursor from one rectangle to another. The rectangle on which the cursor is positioned disappears to reveal a word. When you find the word that matches, you press the spacebar.

We found this a bit boring, especially since moving the cursor quickly made it difficult to control, and we found ourselves accumulating misses simply as a result of poor control. We collected some of our worst scores on this, the easiest game in the series. We also question the educational value of just matching words—even on the elementary school level.

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SOFTWARE PROFILE

Name: Word Radar
Type: Educational game
System: 48K Apple
Format: Disk
Summary: Word matching; less exciting than the others.
Price: $44
Manufacturer:
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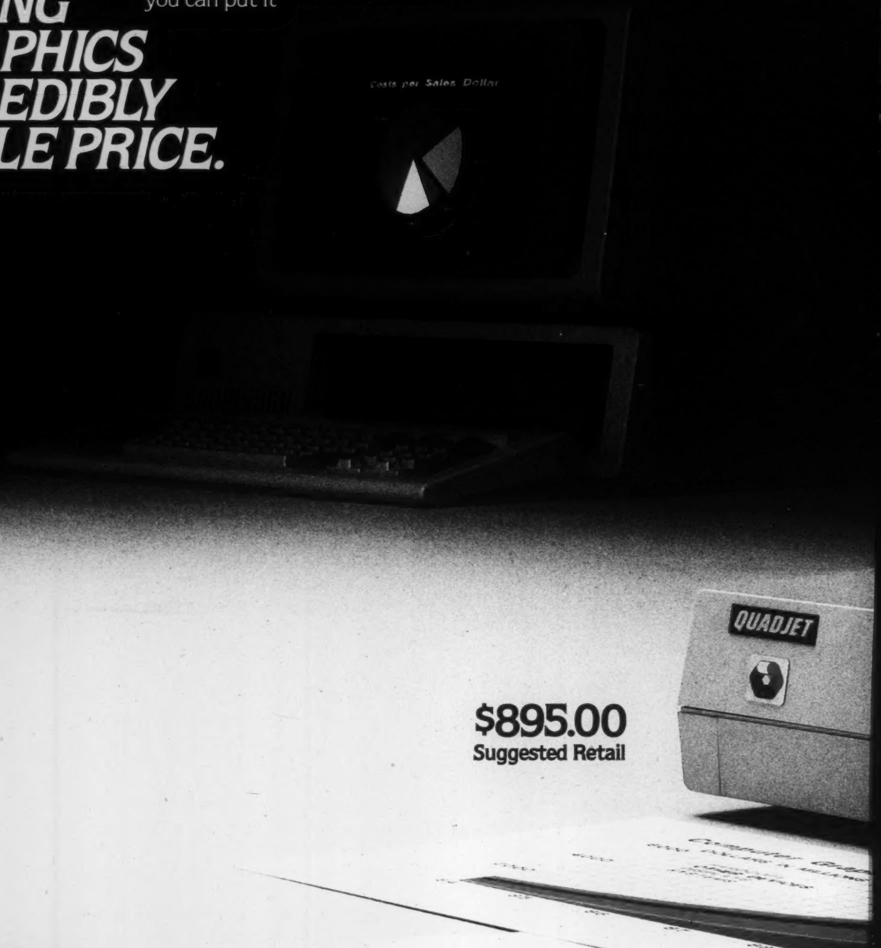

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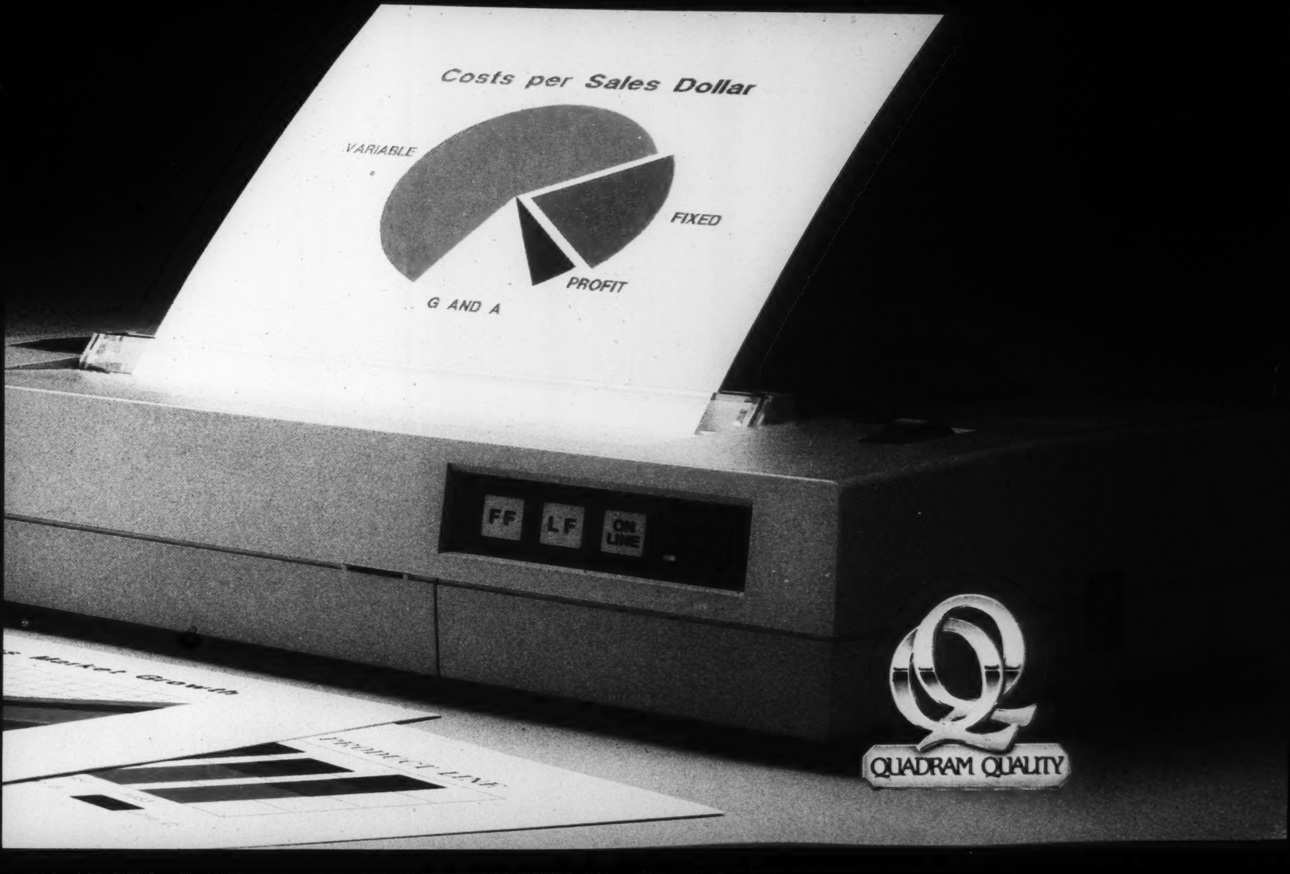
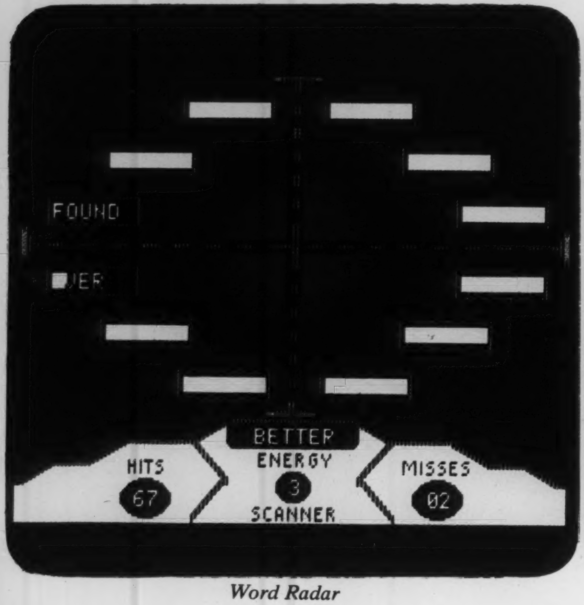
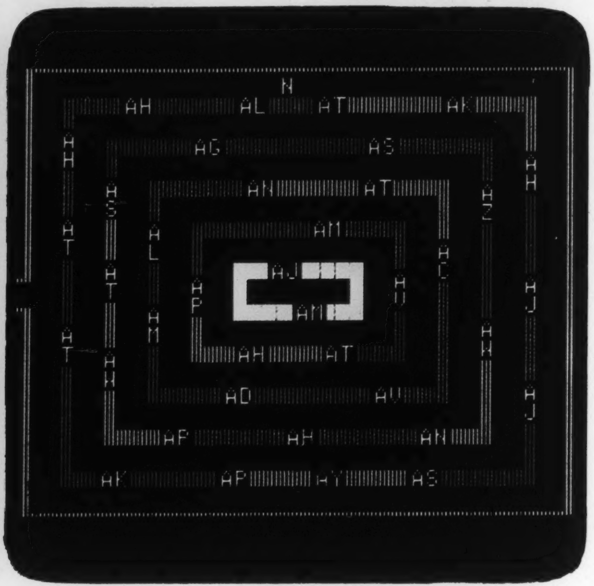




Word Radar



Word Man

Word Man

Word Man is the first successful translation of the Pac maze craze to an educational application that we have seen.

The screen display features five concentric rectangular corridors imbedded in the walls of which are two- and three-letter word fragments. A single letter travels through the corridors at a speed selected from option menu.

Your job is to press the spacebar when the letter passes a word fragment that will make it into a legitimate word. For example, you would press the spacebar when the letter P passed AT, but not when it approached AJ. After a travelling letter has been used, it is replaced by another. When you bypass a non-word, it is crossed out so that you don't have to worry about it anymore.

When you have correctly completed or bypassed all the word fragments bordering on one corridor, you move to the next one in. If you miss one or more possible words, you must go around again until you get them all correct.

Again, the option menu allows you to set the time limit. It also allows you to specify the vowels and patterns you want to practice.

Word Man is lots of fun and has an amazingly large storehouse of three- and four-letter words. We took issue with it on one or two words that we wanted to create and it would not accept, but for the most part, we were quite satisfied with its vocabulary.

The only difficulty we experienced was in reading the letters themselves. It was sometimes difficult to distinguish between M and H, for example, and we "missed" more often than we liked just because we misread the Apple characters.

We found *Word Man* challenging, entertaining, and educational.

creative computing
SOFTWARE PROFILE
Name: Word Man
Type: Educational game
System: 48K Apple
Format: Disk
Summary: Pac-Man learns to spell
Price: $44
Manufacturer:
Developmental Learning Materials
P.O. Box 4000
Allen, TX 75002

The display for Spelling Wiz features a stubby little wizard with a long white beard and a magic wand.

Spelling Wiz

The display for *Spelling Wiz* features a stubby little wizard with a long white beard and a magic wand. In the center of the screen over the wizard's head a word from which one or more letters have been omitted appears. On the lefthand side of the screen you see a list of five possible fill-ins for the word under consideration.

You must use the arrow keys to point the wizard's wand at the letter or letters that correctly complete the word. It may be as simple as choosing O to fill in L_SE or as complex as deciding among similar combinations of I, G, and O to fill in REL___ON.

As in the other games in the series, your time is limited. The option menu allows you to choose lists of common or demon words for grades one through six. There are four difficulty levels.

The odd thing about this package is that the screen illustration on the instruction manual (which also serves as the packaging for the program) bears no resemblance whatsoever to the actual game. The wizard is there, but the concept of the game as illustrated is un-

creative computing
SOFTWARE PROFILE
Name: Spelling Wiz
Type: Educational game
System: 48K Apple
Format: Disk
Summary: Practice spelling by filling in the blanks
Price: $44
Manufacturer:
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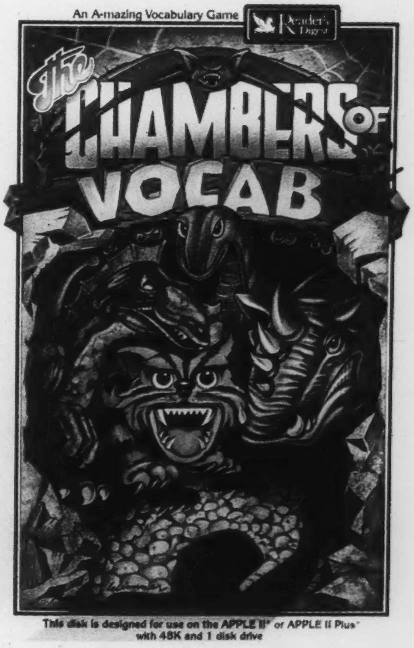
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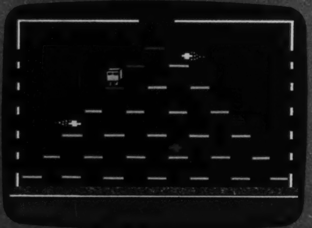

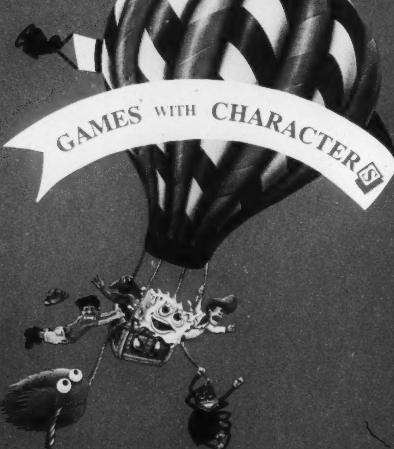

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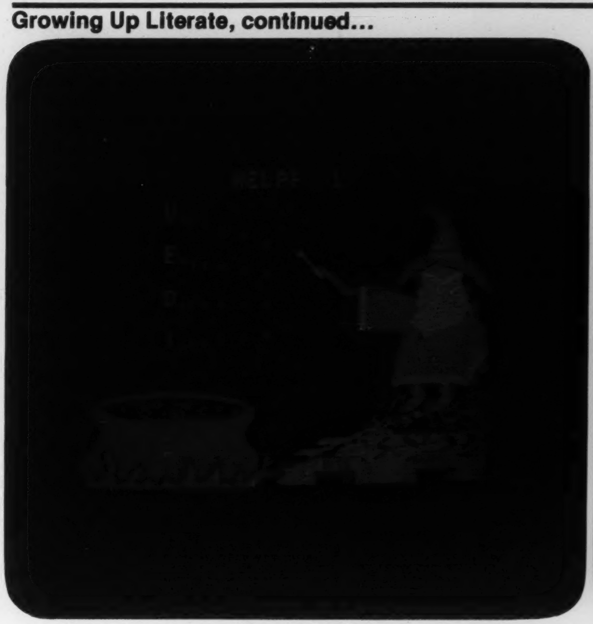
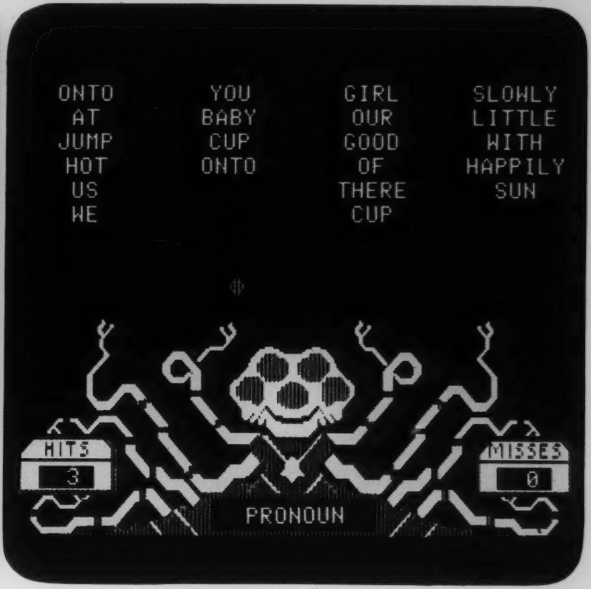


Spelling Wiz



Word Invasion

related to reality. The game is good, but don't judge the book by its cover.

Word Invasion

Saving the best for last, we come to *Word Invasion,* a drill on the parts of speech. Parts of *what?* You know, nouns, pronouns, verbs, adjectives, adverbs, and prepositions—those words for which children don't learn the names these days.

In *Word Invasion,* Alien Octopus covers the bottom half of the screen. On his chest you see the name of a part of speech. From the top of the screen descend four columns of words. You must move the cursor back and forth across the screen and aim at a word that is the part of speech called for. For example, if the word is PREPOSITION and the choices are WE, ONTO, CUP, and SUN, you would shoot ONTO.

creative computing

SOFTWARE PROFILE

Name: Word Invasion
Type: Educational game
System: 48K Apple
Format: Disk
Summary: Practice with parts of speech; the best of the bunch
Price: $44
Manufacturer:
Developmental Learning Materials
P.O. Box 4000
Allen, TX 75002

> ***We think children should be able to identify parts of speech—and a great many other grammatical components as well.***

If you take too long or aim incorrectly, the word lists move lower; if they reach the octopus's arms, the screen clears, the game begins again, and you lose valuable time.

Word Invasion is our favorite game in the series for several reasons. The controls are very simple and accurate, but more important, the skill that is practiced is one we believe to be very worthwhile. We believe strongly in the old fashioned kind of grammar teaching that requires students to offer more convincing justification for their word choices than "It sounds right."

We think children should be able to identify parts of speech—and a great many other grammatical components as well. In fact, one of our fondest dreams is to find a well constructed computer program that drills the case of pronouns. We hear statements such as "Give the money to myself or Jim" so often that we have begun to suspect that case is a totally neglected concept in contemporary English classes.

Summary

Climbing down off the soapbox, we have only a few observations to add to this review. The first concerns controls: The option menus for all of the games offer the ability to use paddles. Usually, we prefer paddle or joystick control for games, but in the case of Arcademic Skill Builders, we can say categorically: Forget it! The paddle control, in all cases, was so poor that it reduced our scores considerably and led to intense frustration. Stick to the keyboard controls; they are simple and effective.

Another feature that we almost always require before we endorse an educational package is the ability to add words or problems to those provided on the disk. DLM does not offer this feature in any of the Arcademic Skill Builders. The word lists in most of the games are more than adequate, however. By limiting the number of hi-res displays on each disk, DLM has left a great deal of room for data, and we think it is safe to say that anyone who masters all the words, relationships, spellings, etc. on a disk has gotten more than his money's worth.

Arcademic Skill Builders are exactly what they purport to be. They offer drill and practice of valuable skills in an entertaining arcade-like format.

Although they are intended to be used by children in grades one through six, the skills are so important and the word lists so varied that the games can be used to advantage by almost anyone. We know very few people who would not benefit from spending a few hours with one or more Skill Builder packages. END

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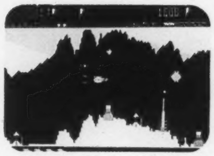

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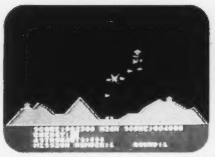

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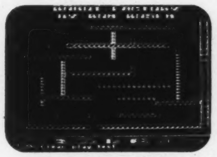

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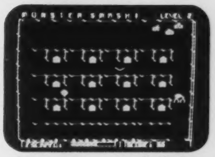

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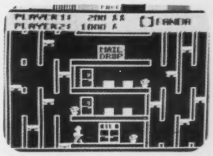

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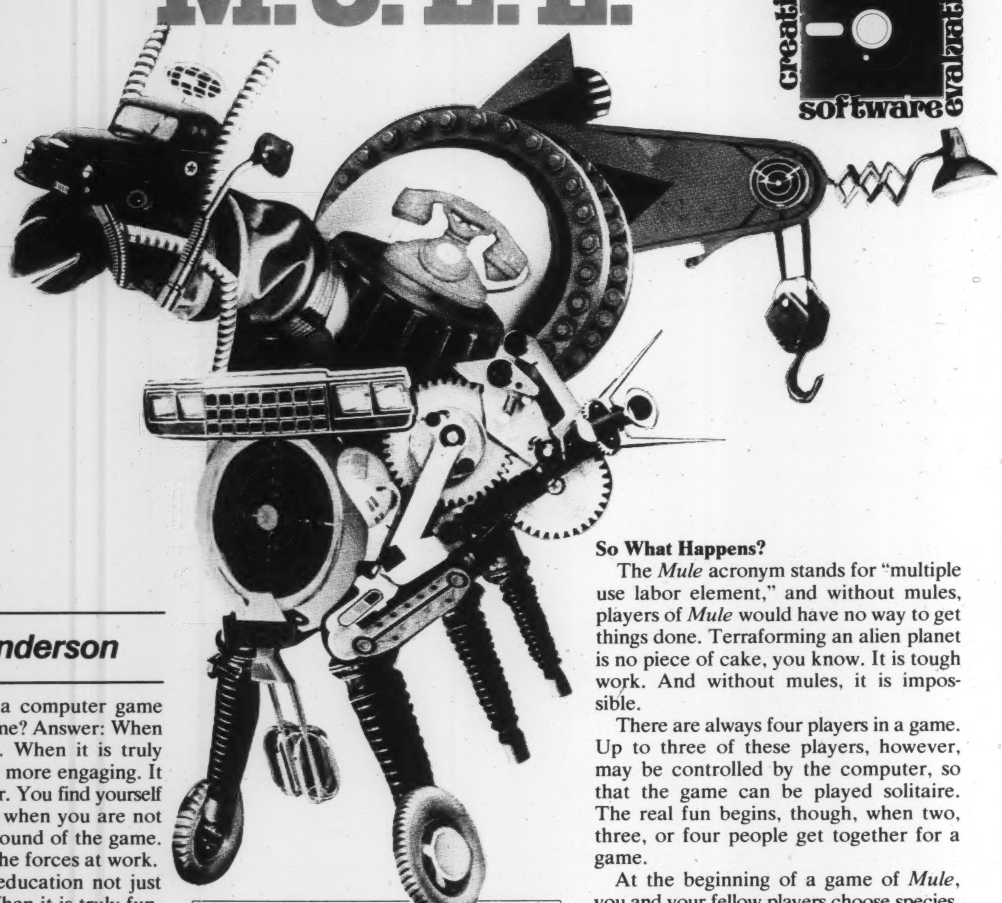
M.U.L.E.

creative computing software evaluation



John J. Anderson

Question: When is a computer game not just a computer game? Answer: When it is truly educational. When it is truly educational, it is much more engaging. It has depth, staying power. You find yourself thinking about it even when you are not involved in an actual round of the game. You begin to analyze the forces at work.

Question: When is education not just education? Answer: When it is truly fun. When it is truly fun, it is much more effective. It makes a lasting impression. The message gets through and stays in your mind. You begin to understand the forces at work.

Question: When is the release of a computer game news in the educational software market? Answer: When the software is from Electronic Arts, makers of *Mule*.

Mule is one of those very rare games—one that embodies the best in a home entertainment program. A good concept and a good follow-through. Professionally mounted, executed, and debugged. Imaginatively packaged. Documented thoroughly and with wit.

Best of all, *Mule* has depth. Each game is different. Each prepares the player to do just a little bit better next time. And though it is a competitive game, *Mule* also demands cooperation for success. I should also mention that there is no shooting to be found anywhere in the game. How positively refreshing.

creative computing
SOFTWARE PROFILE

Name: M.U.L.E.

Authors: Bill Bunten, Dan Bunten,
Jim Rushing, Alan Watson

Type: Multiplayer strategy game
System: Atari
Format: Disk
Language: Machine

Price: $40
Summary: The kind of game that shows what microcomputers are for.

Manufacturer:
Electronic Arts
2755 Campus Dr.
San Mateo, CA 94403
(415) 571-7171

So What Happens?

The *Mule* acronym stands for "multiple use labor element," and without mules, players of *Mule* would have no way to get things done. Terraforming an alien planet is no piece of cake, you know. It is tough work. And without mules, it is impossible.

There are always four players in a game. Up to three of these players, however, may be controlled by the computer, so that the game can be played solitaire. The real fun begins, though, when two, three, or four people get together for a game.

At the beginning of a game of *Mule*, you and your fellow players choose species. Each species has its own look, and some have special handicaps I shall describe later. The players are then allotted money and supplies.

Each ensuing round of play includes a land grant, during which the players vie for plots of real estate shown on a screen map (see photo). One of the pleasures of the game is how simply user input is handled—through the joystick and trigger. The only time the keyboard must be touched is to choose the level of play and to begin, pause, or restart a game.

Each player then gets a turn. He may choose to produce energy or food, or to mine a plot of owned land. To outfit a plot, you use the joystick to move your player into the corral in town. The screen automatically zooms in to a close-up view of town. After you have paid for and obtained a mule, you go to the outfitter of your choice, located on the north side of town, and suit up. Then you march the mule out to the plot of land you wish to outfit, and drop the production symbol

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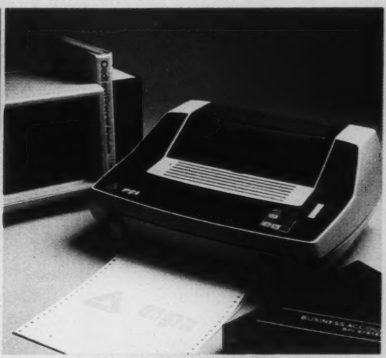

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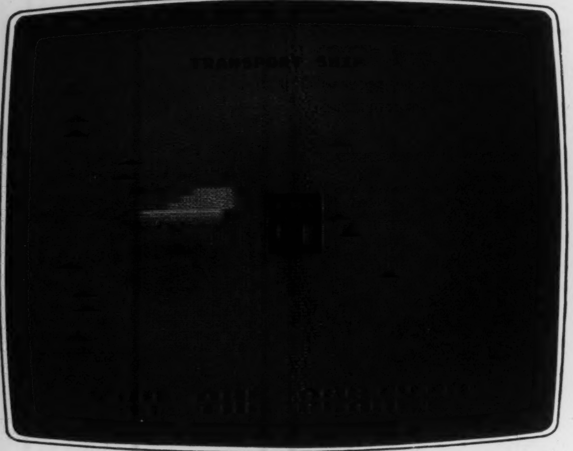
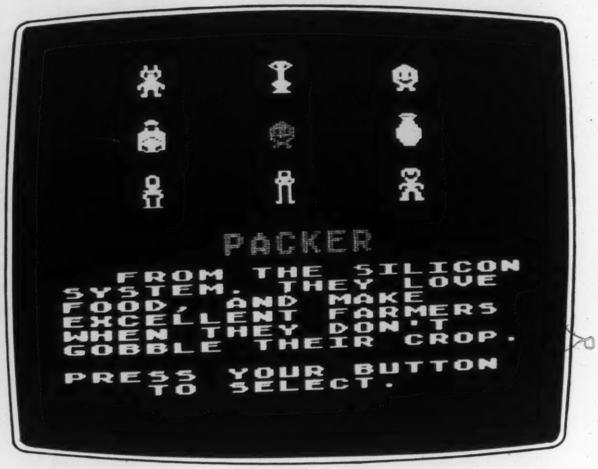


At the beginning of the game, you arrive on an alien planet. Your job: colonization. Your objective: riches.



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onto the plot. It is that simple—you are literally in business.

In the first two of the three available levels of play, you can use up extra time in a turn by hunting for the Wampus. If you catch him, he will pay to be let go. You can also visit the pub, where your gambling luck invariably runs strong.

Random events, like planetquakes, acid rain, and pest attacks, occur throughout the game. They change the conditions of the game, but as they can't really be anticipated, there is not much reason to worry about them.

At the end of each round of a game, there is a production sequence. During this sequence, all players watch how their little colony is doing. Then the really fun stuff comes along.

The Market Phase

After the production sequence comes the market phase of each round. If you have a surplus of any commodity, you may choose to sell it: either to the colony store or to one or more other players. If you have a shortage, you may buy from the store or other players—assuming, of course, you have the cash.

The free enterprise system, you see, is really what *Mule* is all about. For each commodity in every round there is an auction. Each player can declare as either buyer or seller. Using the joysticks, players determine what transactions take place. The store sets its own prices, but sellers can set their prices as well. And then all heck breaks loose.

The trading sessions in *Mule* are the best part of the game. Players use the joysticks to march their characters up and down the screen, setting sellers' and buyers' prices (see photo). Trading takes place when a seller's line meets a buyer's. At the bottom of the screen, the statistics are listed, including prices and amounts traded. Furthermore, this process takes place against the clock. Trading therefore is usually frenzied and cutthroat.

The description I am providing makes the marketing process seem complex, but one of the foremost strengths of *Mule* is that it makes the trading process intuitively understandable, even for kids and the likes of me. Moving your player up and down to establish your price on an item is a great visual aid. Most kids won't realize, of course, that the auction screens are actually bar graphs mapping supply vs. demand prices. So why spoil their fun?

The trading sessions in Mule are the best part of the game.

At the conclusion of each round, a summary report screen is shown. This shows each player's net worth, in money, land, and goods, after every round. It is the scoreboard, in a sense, by which players determine how they are doing, and, of course, whom to dump on in the next round.

Three Levels of Play

There are three levels of play available in *Mule*. The beginner's game lasts for six rounds and keeps things pretty simple. Prices have fixed ceilings, and you cannot sell goods beyond your own critical level.

The standard level lasts for twelve rounds, and introduces some new wrinkles. The store will auction land at the end of each round. Players can also choose to sell off plots of their own land. The most interesting alteration in this game has to do with the mules themselves. The standard game starts out with 16 in the corral, and new ones can only be built with "smithore" mined from players' plots of land.

This means that the player or players who control smithore also control the price and availability of mules—and remember, no development can take place without them. Prices can go as high as the traffic will allow in the standard game, and players may sell their goods beyond a critical level if they so desire.

The understated documentation comments on the distortion of screen-graphed prices when no ceilings are imposed, players are desperate, and the clock is ticking down: "This allows shrewd players to take advantage of their friends." It does indeed.

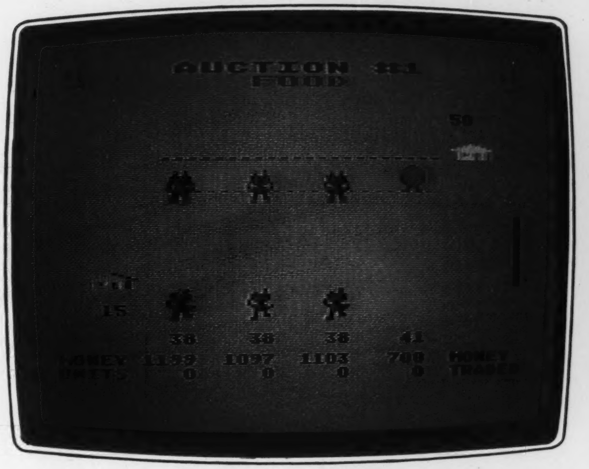
In the third, or "tournament" level of play, things really get hot. My advice is to play with *really* good friends, total stangers, or better yet, enemies. This level sometimes makes you wish you had a tactical nuclear device or two to bring into play.

While you can still mine smithore in the third game level, and it remains a necessary commodity in the production of mules you may also choose to mine for "crystite." This commodity is quite a bit like diamonds on earth. It is very valuable, and its price can swing outside of any constraints tied to supply and demand. You can assay plots to determine crystite content, or just outfit for crystite and hope for the best.

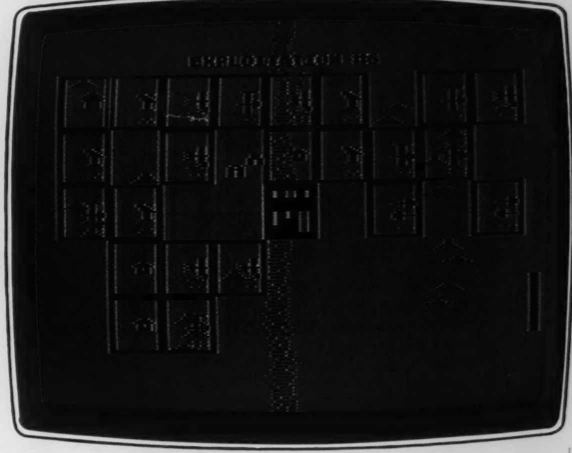
Complications

However crystite, like diamonds, can be a dangerous commodity. A pirate ship may appear up to twice in a game, When it does, it steals *all* crystite produced.

The concept of collusion is also introduced in the tournament level. This allows players to conclude private deals. During



During a commodity auction, the animated players themselves graph transactions as they occur through joystick control.



After a few rounds, the settlement begins to take shape. Food is best produced in the river valley, energy in the desert.

a product auction, two or more players press their triggers simultaneously. A special collusion screen appears, and only those who pressed the trigger get to trade for that commodity during that countdown. The regular auction then continues. Collusion can even take place in your land deals. Here is where you will find out how good your good friends really are.

The store may also burn during a tournament game, making things much more competitive within the colony. After a fire in the store, prices skyrocket, and players can corner the market on one or more commodities.

Mule is addictive, nonviolent fun. It demands cooperation as well as competition between players. If the net worth of the colony falls below a certain number at the conclusion of the game, all players are considered to have lost. The real way to riches is to make sure your opponents at least have the money to buy what you wish to sell—then you can try to come out ahead.

Best of all, *Mule* is a vibrant model of the free market system at work. Prices are set by supply and demand. Economies of scale provide increased productivity for adjacent plots under a single commodity and owner. The Learning Curve Theory of production provides increased productivity over time. The law of diminishing returns eventually acts to mitigate these effects. The Prisoner's Dilemma penalizes excessive selfishness. The documentation describes how these effects work, and how to best harness them.

If beginners or youngsters need a bit of a boost, they can choose the Flapper character and get more money and time. Expert players can choose the Humanoid character and have the handicaps of less money and less time. Playing the solitaire game as a Humanoid facing three computer opponents makes for a real challenge.

A quick digression. Those readers who have been following "Outpost: Atari" recently know of the changes Atari owners have sought and gained from Atari. One place where we lost, however, was on the point of joystick ports: the new generation of Atari machines still has only two. When we pressed Atari on the point, they said they knew of no games that required four joystick ports (even though their own early version of *Asteroids* could be played simultaneously by up to four players).

Mule dramatically shows how shortsighted (and possibly chintzy) was the decision to chop off ports three and four on new machines, limiting human opponents to two. *Mule* is a game the whole family can play and enjoy over and over again, and be richer for the playing. Four can play only on the older models 400 and 800, which have four joystick ports. Please, Atari, wise up and reconsider.

Two ports or four, *Mule* belongs on every Atari software shelf in the world: in every home and every school, near every Atari. *Mule* points a strong way to the future of quality entertainment and educational packages—where the concepts of education and entertainment are mutually beneficial to, and totally integrated with, each other.

Congratulations, Dan and Bill Bunten, Jim Rushing, and Alan Watson, for a masterful job. We shall be watching you, and Electronic Arts, closely. ■

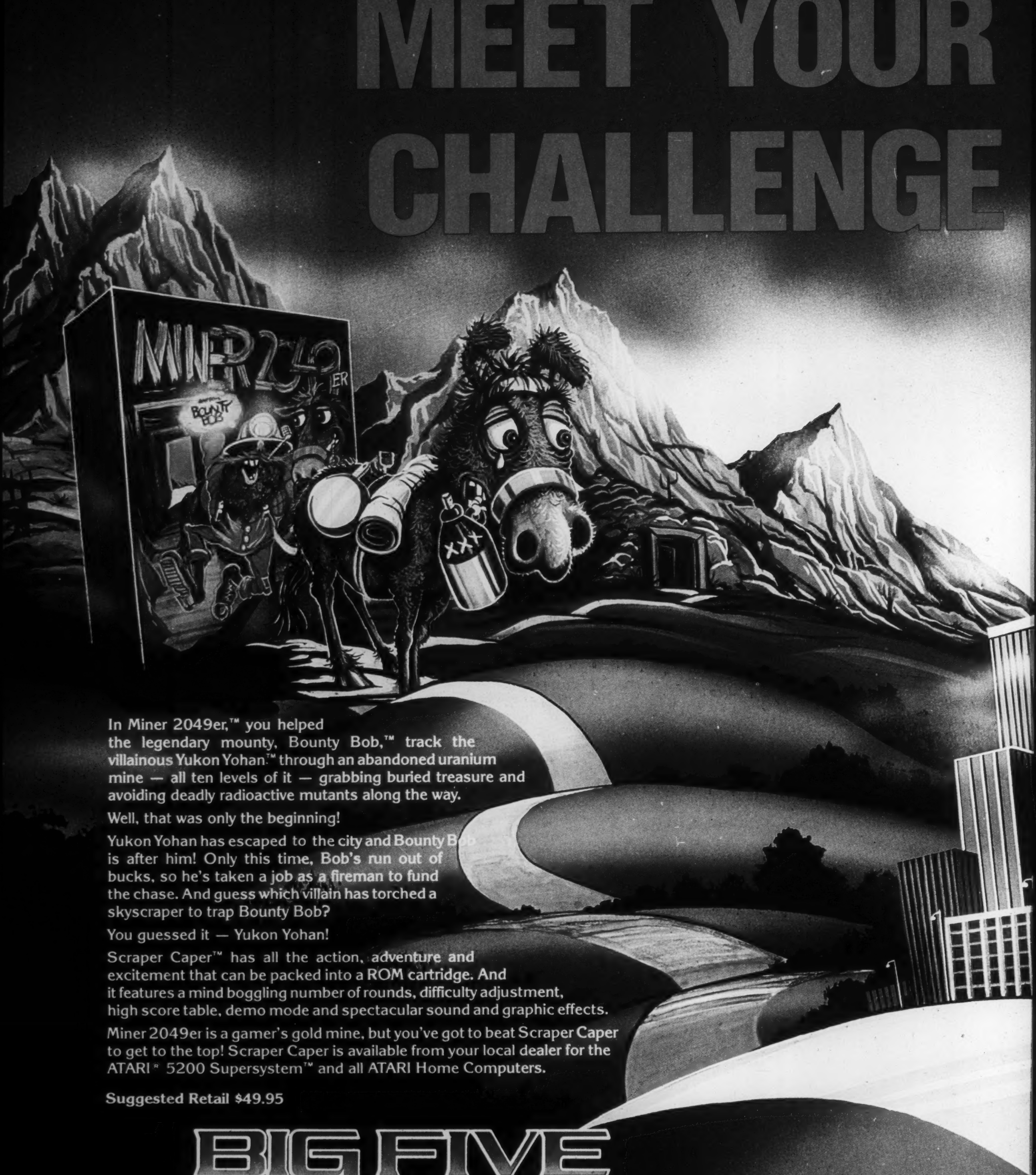
(Food Symbol) Food determines the amount of time you have during Development. Average production for food in the River Valley is 4, in the Flatlands 2, and in Mountains 1. Food prices range from $15 to $250. The outfitting cost for a food producing M.U.L.E. is $25.

(Energy Symbol): Energy is used in the production of all products except Energy itself. The amount you need is based on the number of non-energy plots with M.U.L.E.s plus 1. Average production of Energy in Flatlands is 3, in the River Valley is 2, and in Mountains 1. Energy prices range from $10 to $250. The outfitting cost for an energy producing M.U.L.E. is $50.

(Smithore Symbol): Smithore is used in the production of M.U.L.E.s in the Standard and Tournament games. The store will produce 1 M.U.L.E. for every 2 Smithore units it buys from players. Average production of Smithore in the Flatlands is 1, in the River Valley is 0 (you may not mine Crystite or Smithore in the River Valley), and in the Mountains 1 plus the number of mountain symbols in your plot (1 to 3 mountain symbols). In the Beginner's game Smithore has a fixed price of $50. In other games Smithore prices range from $25 to $250. The outfitting cost for a Smithore producing M.U.L.E. is $75.

(Crystite Symbol): Crystite can only be found when playing the Tournament game. All Crystite found is shipped off planet. Please refer to the Tournament game instructions for the locations of Crystite. Crystite prices range from $50 to $150. The outfitting cost for a Crystite producing M.U.L.E. is $100.

The four basic commodities of Mule: food, energy, Smithore, and Crystite.



In Miner 2049er,™ you helped the legendary mounty, Bounty Bob,™ track the villainous Yukon Yohan™ through an abandoned uranium mine — all ten levels of it — grabbing buried treasure and avoiding deadly radioactive mutants along the way.

Well, that was only the beginning!

Yukon Yohan has escaped to the city and Bounty Bob is after him! Only this time, Bob's run out of bucks, so he's taken a job as a fireman to fund the chase. And guess which villain has torched a skyscraper to trap Bounty Bob?

You guessed it — Yukon Yohan!

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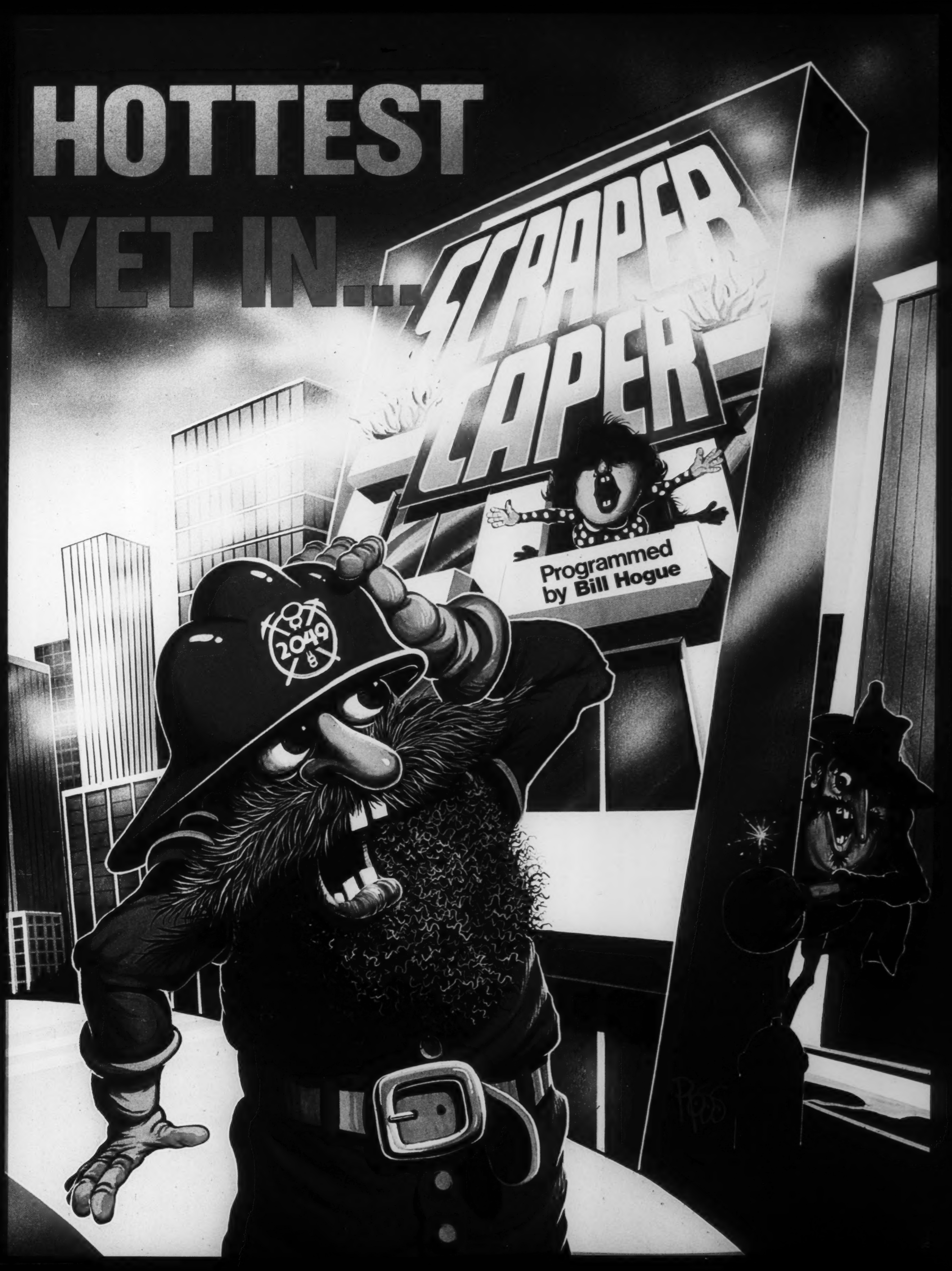
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PLANETFALL
STELLAR PATROL
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STELLAR PATROL OF THE THIRD GALACTIC UNION
Greetings from
PLANETFALL
Historic RAMOS II

With each new release, each new venture into a genre they have made famous, the people at Infocom, authors of *Zork* and *Deadline*, seem to reaffirm a commitment to a level of quality and innovation that has guaranteed them not only a fiercely loyal following, but also an undisputed position at the forefront of the computer adventure market.

Being in such a position can have its drawbacks, not the least of which is striving to maintain the level of quality and excellence for which they are known. Thus far this year, with the releases of Michael Berlyn's *Suspended* and Stu Galley's *The Witness*, they have done nothing but strengthen their position. And now there is *Planetfall*, a new science fiction adventure by another first time Infocom author, Steve Meretsky.

Planetfall

Planetfall is as remarkable, funny, perplexing, and entertaining a game as you are likely to find anywhere. It begins with you, a lowly ensign seventh class, scrubbing deck nine of the Stellar Patrol Ship Feinstein. Thanks to a certain Ensign First Class Blather, this tour of duty has not been everything you had hoped it might be. However, things are about to take an unexpected turn and not necessarily for the better.

> ***Like Zork, Planetfall is big—more than 100 rooms.***

Cast alone into space, you soon find yourself marooned on one of two twin islands in the middle of the strange water-covered planet working hard just to find a little food and a safe place to sleep. As night falls on the first day, and you prepare to bed down in a large empty dormitory, you will have wandered about and mapped most of a huge complex called Kalamontee.

When you wake again, the real adventure begins as you try to discover why the complex was apparently abandoned and what happened to those who were there before you.

In your search for answers to these and other questions, you will find a friend, a robot named Floyd, who will prove to be as good and true a companion to you as E.T. was to Elliot.

Clearly, the most imaginative and cleverly written part of the entire game, Floyd, besides being hysterically funny through most of the adventure, evokes in the player of *Planetfall* authentic feelings of affection and attachment. Indeed, Floyd is critical to finishing the game in terms of being a large part of the solution to three major problems in *Planetfall* besides lending his own brand of moral support to the stranded and baffled adventurer.

Like *Zork*, *Planetfall* is big—more than 100 rooms and much of the fun of the game is found in exploring the vast twin complexes of Kalamontee and Lawanda. In fact, each area of *Planetfall* seems to lead you on to the next, holding your

creative computing
SOFTWARE PROFILE

Name: Planetfall

Type: Text adventure

System: Apple, Atari, IBM PC, Commodore 64, TRS-80

Format: Disk

Summary: Best entry level adventure from Infocom. Logical, funny, entertaining.

Price: $49.95

Manufacturer:
Infocom, Inc.
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attention yet never becoming so obscure as to drain your enthusiasm.

The level of difficulty is, of course, subjective; it took me 30 to 40 hours to acquire all 80 points, thanks mostly to a disastrous oversight in mapping, two red herrings, and one particularly challenging puzzle near the end of the game. Still, the solutions to the more difficult puzzles never quite seem unattainable, so the hours spent locked to the computer do not feel wasted.

The puzzles in *Planetfall* are, for the most part, of an interactive nature, meaning that objects like special access cards, keys, and other tools must be combined in a variety of ways to find solutions to the problems presented.

Fortunately, this game has probably the most logical and straightforward puzzles of any Infocom adventure, so patience and perseverance are rewarded without any unnecessary reliance on sheer luck.

In terms of danger, there are few instances in this game where the player runs the risk of happening upon the kind of gratuitous death one finds in both the *Zork* trilogy and *Starcross*. The risks one takes in *Planetfall* are ones for which he can prepare, and in most cases only carelessness evokes the standard ***You have died*** response from the program.

Text IS Fine

Planetfall is a perfect argument in favor of text adventures. The detail present in the descriptions—that which is provided for the mind to see—and those special parts of the game that produce a kind of running action, would simply appear like so many Saturday morning cartoons on a hi-res screen, effectively weakening both the excitement and the drama in those sequences. Though, again, this type of game requires more than a passive involvement from the player and indeed, will not give up many of its secrets without both an intellectual and imaginative investment from the player. For my part, as in reading a good book, this is as it should be.

> ***If you do find a likely suspect, it is possible that a jury will release him because your evidence is not compelling.***

The documentation for *Planetfall* includes, among other things, a manual and a very funny diary. The manual especially is well worth reading since the people at Infocom tell me that the majority of problems stranded adventurers ask for hints on can be avoided by a careful examination of the command and advice instructions. (I say this from experience having spent at least a month longer than I should have in the Riddle Room of *Zork II* through a failure to read carefully the instructions for speaking to other characters in the game.)

To my mind, *Planetfall*, is the most entertaining Infocom program yet, particularly on the first time through. It has a liveliness to it that never seems to falter, and the ending is without a doubt the most satisfying yet.

First time author Steve Meretsky has written a game that is most of all fun to play, which is really what these games are all about. As an entry level game for those who have yet to try one of Infocom's adventures, *Planetfall* deserves a large audience.—*MS*

DETECTIVE
The Register
FINAL EDITION
BORAH WARNS OF WAR DANGER
WITNESS
WESTERN UNION
The WITNESS
SOMEBODY'S GOING TO TAKE THE DEEP SIX!

The Witness

Many Infocom games include maps, clues, and other devices that help you in the game. *Witness* includes a telegram, a suicide note, a pack of matches, a newspaper front page, and an issue of *National Detective* magazine which contains hints for playing the game.

Witness is a murder mystery that takes place in 1938. An interesting twist on this theme is that the murder takes place while you are talking to the victim! You can't prevent the murder—that would make for a short game. You must discover who the murderer is and gather enough evidence for a conviction. It isn't enough to have some evidence and a strong hunch. You must prove beyond a reasonable doubt that the accused committed a murder.

The game begins as you are called to the mansion of a Mr. Linder. His wife recently committed suicide, and her ex-lover has threatened to kill Linder. While you are in the mansion, Linder is killed. The ex-lover is seen running through the woods behind the house. Did he commit the murder? Is the case closed? Monica, Linder's daughter and the Oriental butler seem to be involved in the case. Where? How? What secrets are they hiding?

As the red herrings begin to pile up, you race against the clock to solve this difficult case. You can question the suspects, but if you are too aggressive or too fawning, you will not get far. Suspects can also lie, whether they are guilty or innocent. You must discover the truth about Linder, his wife, her lover, and the murderer.

You have an assistant who performs laboratory analysis on fingerprints and other evidence. If you find yourself in a tough spot, he will even help save your life.

If you do find a likely suspect, it is

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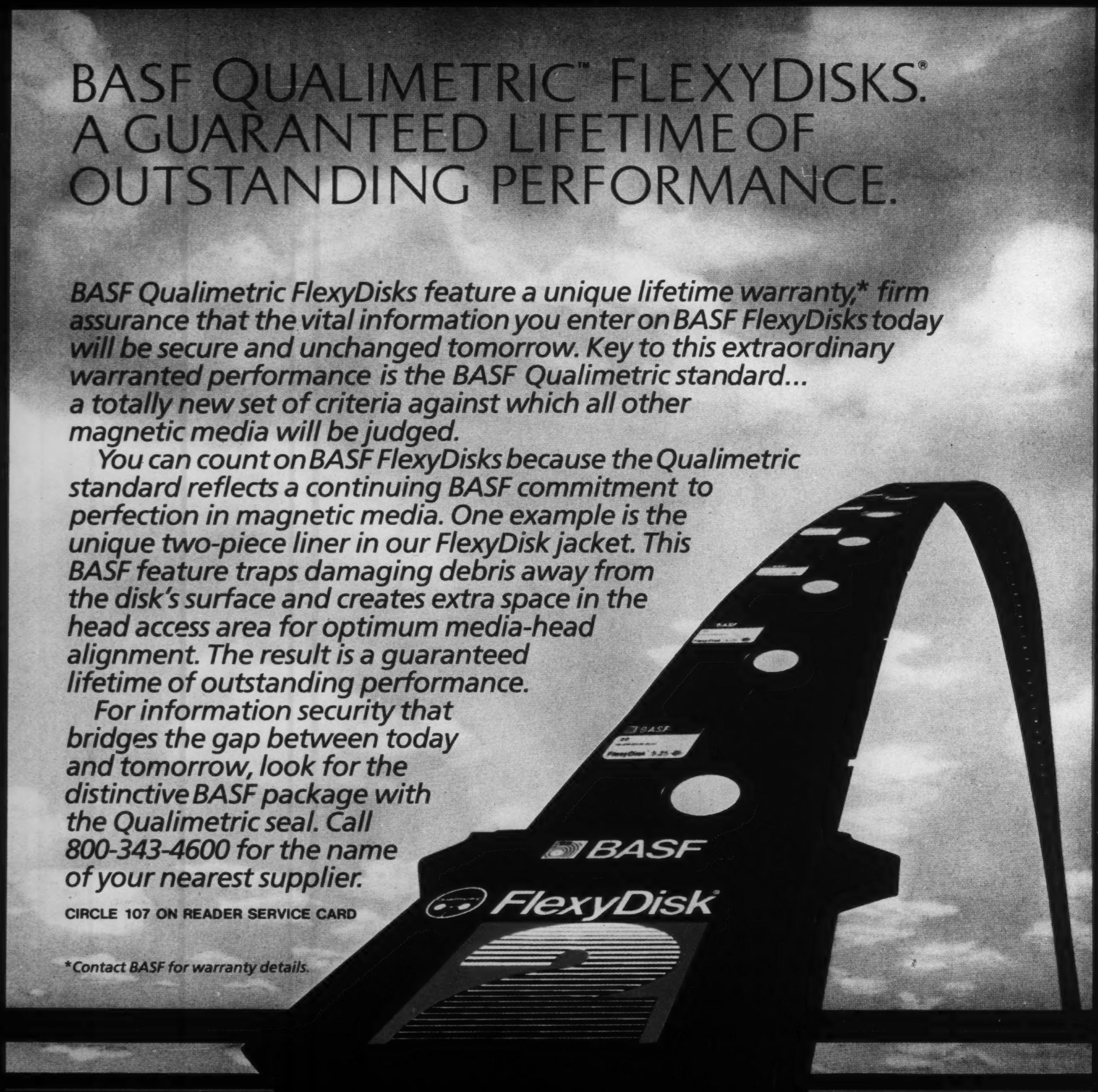
SOFTWARE PROFILE

Name: The Witness
Type: Mystery
System: Apple II+, IIe
Format: Disk
Language: Machine
Summary: Tough, involving, and a winner.
Price: $49.95
Manufacturer:
Infocom, Inc.
55 Wheeler St.
Cambridge, MA 02138



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Infocom, continued...

possible that a jury will release him because your evidence is not compelling. Make sure that you have an iron-clad case or a murderer may be set free.

Infocom has come up with another fine game with *Witness*. They really have no competition. No other text adventure game has such a sophisticated parser. Most only allow the input of simple commands. Infocom's innovative parser lets you link commands in one sentence, making the game seem more natural and life-like.

Their packaging of games is also innovative. Whether it is *Witness*, *Deadline*, *Suspended*, or *Starcross*, the package of each game is related to the action. *Witness* has clues in a police file. *Suspended* has a map of the underground complex in which it takes place and markers for the robots, in addition to memos from the director of the complex.

Getting you into the right frame of mind is as important as the playability of a game. Infocom is rare in that it believes this philosophy.

Witness is not for a beginner at text games. I solved the mystery through luck rather than hard detective work. It may take you quite a long time to solve this case. If you have ever longed to work with Philip Marlowe, Miss Marple, or Lord Peter Wimsey, *Witness* is the next best thing.—*SA* END

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David and James Grosjean

Keystroke Management

Keystroke Management is just one tape in a line of software from 2-Bit Software geared to the 2K TS1000. This tape has four games, all with business themes.

The first, Musical Desks, is an action game in which you play musical chairs with vice-presidential desks; when the desks stop moving, you must be next to one of the six desks or else you are out of the game (and out of a job). Of the 100 skill levels, 1 is the fastest and 100 is the slowest. Level 1 is extremely difficult. Musical Desks has remarkably smooth and rapid graphics for a 2K game. This is probably the best game on the tape.

creative computing

SOFTWARE PROFILE

Name: Keystroke Management

Type: Arcade

System: Timex Sinclair 1000 with 2K RAM.

Format: Tape

Language: Basic and Assembly

Summary: Four challenges in 2K with business scenarios.

Price: $14.95

Manufacturer:
2-Bit Software
P.O. Box 2036
Del Mar, CA 92014

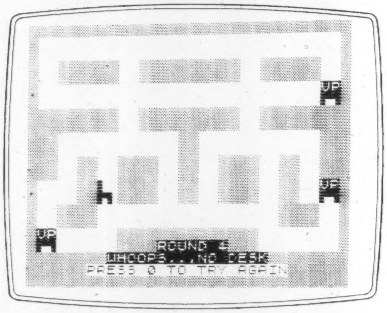
The next program, Corner Office, is a maze-type game in which you try to get through the invisible corporate maze and arrive at the corner office. You control the direction of movement up, down, right, and left. An interesting facet of this game is the fact that you can go only one way down some of the passages. The graphics in this game are also quite smooth.

The third game, Office Automation, is fast-paced. You must avoid voice mail, desktop computers, and satellite teleconferences that are out of control. If you run out of time before you get to the end or if you hit one of the hazards, you lose. The keys L and R turn you left and right. This hectic game will challenge you for quite a while. Although it is basically the same every time, it poses some difficulty because the controls are difficult to master.

All 2-Bit Software packages are well-documented.

The last game, called Go to the Top, is a very different kind of adventure game. The reward is a key to the executive washroom. This is attained by climbing up the ladder of success using several commands including Kiss Up, Tred on Toes, Fire, and Hire. You start with ten years and gain a year every time you are promoted; if you are demoted, you lose a year. Of course, when you are out of years, you lose. Sometimes certain moves are not allowed on a given level, and the message CAREER PLATEAU appears. This game is very complicated and will stump you for a long time. I recommend that as you play you make a map of what moves get you where at which levels.

Of the four games, Musical Desks is the best because of the random element and the fast action involved. Considering the memory limitations of the TS1000, this pack of programs is outstanding. All 2-Bit Software packages are well-documented. They are best for people who are using the TS1000 as an introduction to computers and who do not plan to expand the TS1000 at all and for those who want to press the 2K machine to its limits.—*DG*



```
ROUND 4
WHOOPS...NO DESK
PRESS 0 TO TRY AGAIN
```

TS Destroyer and Space Raid

TS Destroyer and *Space Raid* are two outstanding 2K games in one package. The excellent graphics and fast action are matched by only a few of the best 16K games.

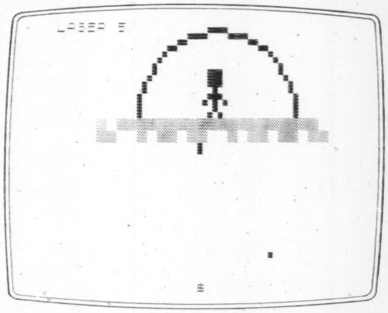
TS Destroyer is a Defender-type game: you fly over an enemy planet with a two-line terrain moving very rapidly from left to right under you. Attacks come from three quarters: warships, which shoot unavoidable guided missiles at you (you must shoot the warship or the missile); meteors, which you can avoid or shoot; and a robot ship behind

---

David and James Grosjean, 50 Kings Rd., Chatham, NJ 07928.

you, which you cannot shoot but which is constantly homing in on you and shooting at you with deadly accuracy. You can choose your skill level from 1 (fast) to 30 (slow). The keys 6 and 7 move you up and down, and 1 or 0 fires.

Requiring an adroit combination of reflexes and strategy, TS Destroyer is a game that will not bore you easily. The hazards—especially the robot ship—keep you moving constantly. The strategy involves making your various enemies destroy each other, temporarily allowing you to focus your attention on the warship.



One of the best features of this program is that it is a hybrid Basic/machine code game. This allows you to modify the program to your own specifications. The directions give you all the information you need. You can even add a score if you have 16K. Because there is some Basic in the program, you can break out of the game at any time.

creative computing

SOFTWARE PROFILE

Name: TS Destroyer and Space Raid

Type: Arcade

System: Timex Sinclair 1000 with 2K RAM

Format: Tape

Language: Basic and Assembly

Summary: Superb 2K games with 16K power.

Price: $14.95

Manufacturer:
Softsync, Inc.
14 E. 34th St.
New York, NY 10016

The second program, Space Raid, also has excellent action. After you have chosen a skill level from 0 (fast) to 9 (slow), you are confronted by the alien spaceship with the alien inside. The object is to shoot through his defenses and destroy him. Using only five laser bases, you must avoid his laser cannon (which is deadly accurate) and blast through the two defense rings rotating in opposite directions under his feet. You must hit him in the left foot, his only vulnerable spot. Your laser bases can move left and right and fire from any position.

Space Raid is fast and exciting. Ten skill levels and a dangerous enemy laser can keep you challenged for hours. Since this is also a hybrid Basic/machine code game, you can break during play and make modifications. Unfortunately, the modification documentation for this game is not as complete as for TS Destroyer.

Although both games can be modified by the user, extensive modifications require 16K. Nevertheless both are superb as they are.—*DG*

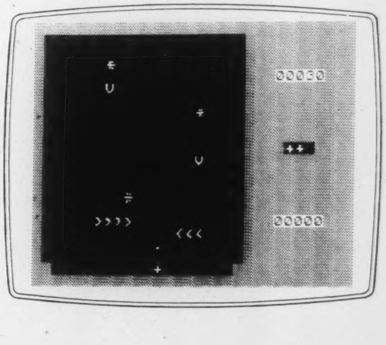
Millepede

Millepede is a simple version of the type of game represented by Centipede, Atari's popular arcade game. The millepede consists of ten segments which are represented by > or < depending on which direction it is going. The playing area is a 20 x 20 square. On the right of the screen is displayed your score, the high score, and your remaining lives.

You are at the bottom of the screen; you can move only left and right. The object of the game is to destroy all the millepedes before they get you. You start shooting when the millepede enters the playing area in the middle of the top.

As in the arcade game, hitting a segment of the millepede changes it to a mushroom. When the insect hits a mushroom and advances, it changes direction. These mushrooms drop things on you that are indestructible and lethal. This is the limit to the hazards of the game. As the game progresses, everything gets faster, and the mushrooms get more accurate with their bombs. Even though the familiar hazards of fleas, scorpions, and spiders are missing and the game lacks the complexity of arcade style games, it is more than challenging because of the speed later in the game.

Since the game is written in machine code, it is fast and the graphics are smooth. By not using the whole screen, the vertical orientation of the arcade style is retained—a definite plus. The fact that your movement is limited to left and right is not a big hindrance since the millepede does not wiggle back up the screen when it hits the bottom; you simply lose one life. Another positive point is that, when you lose a life, the screen quickly goes inverse twice and play resumes immediately.



creative computing

SOFTWARE PROFILE

Name: Millepede

Type: Arcade

System: Timex Sinclair 1000 with 16K RAM.

Format: Tape

Language: Assembly

Summary: Fast action fun in arcade style.

Manufacturer:
Axis Software
71 Brookfield Ave.
Loughborough, U.K. LE11 3LN

Also included on this tape is a game called Road Runner. This is a weak version of the Carnival type of arcade game. There are no pipes, animals, or bonuses; only inverse numbers traveling in three rows across the screen. Although the action picks up as the game goes on, the overall slowness of the game is a serious shortcoming.

The documentation for these games is quite complete.

In short, *Millepede* is an excellent game because of its smooth, fast graphics and the quality of fun it offers. In comparison Road Runner is slow and unexciting.—*DG*

Meteorites

Meteorites is a simple version of the arcade game type represented by Asteroids, Atari's immensely popular game. Your objective is to destroy the meteorites shown on the screen before they destroy all three of your ships. The playing area, made up of inverse spaces, takes up the entire screen except for the top line where your score and ship indicator are displayed.

At the beginning of the game your first ship is already in position. It is represented by a number 0 through 7, depending on the direction it is facing: zero shows up; 2, right; 4, down; 6, left. The odd numbers represent diagonal positions. This system for showing the ship position is easy to get accustomed to.

The controls allow you to rotate clockwise and counter-clockwise, thrust, and fire. The first two meteorites appear, and you begin firing. Your ship may fire

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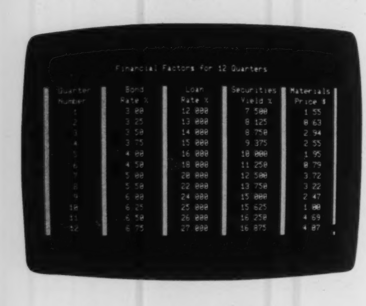

```
                Financial Factors for 12 Quarters

 Quarter       Bond         Loan      Securities   Materials
 Number       Rate %       Rate %       Yield %     Price $
    1          3.00        12.000        7.500       1.55
    2          3.25        13.000        8.125       0.63
    3          3.50        14.000        8.750       2.94
    4          3.75        15.000        9.375       2.55
    5          4.00        16.000       10.000       1.95
    6          4.50        18.000       11.250       0.79
    7          5.00        20.000       12.500       3.72
    8          5.50        22.000       13.750       3.22
    9          6.00        24.000       15.000       2.47
   10          6.25        25.000       15.625       1.00
   11          6.50        26.000       16.250       4.69
   12          6.75        27.000       16.875       4.07
```

Sharpens Students' Decision-Making Skills

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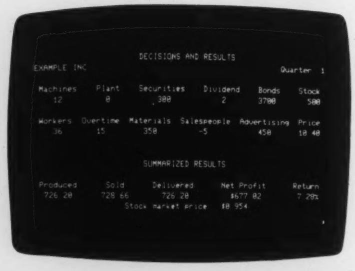
Getting Started is Easy

Corplan requires no previous knowledge of computer operation or business programs. Students make decisions based on data supplied by the program and then enter their decisions into the computer. The computer calculates the results of the decisions and offers immediate feedback (such as "stock market price", "plant congestion" or "bankruptcy"). Corplan's menu-driven programs provide information and planning aids whenever requested. Reports provide needed information on the parameters of the corporation and the world in which it operates: taxes, efficiency of labor and machines, effectiveness of advertising, financial and operational forecasts, production rates, prices and market factors. Corplan also maintains complete accounts and balance sheets for each quarter.



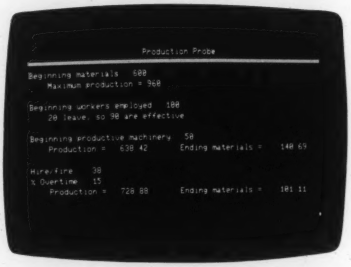
```
                      DECISIONS AND RESULTS
EXAMPLE INC                                            Quarter  1

Machines     Plant     Securities    Dividend    Bonds      Stock
   12          0           300           2        3700        500

Workers   Overtime   Materials   Salespeople   Advertising   Price
   36        15         350          -5            450       10.40

                       SUMMARIZED RESULTS

Produced       Sold        Delivered       Net Profit       Return
 726.20       728.66        726.20          $677.02          7.20%
                 Stock market price   $0.954
```



```
                       Production Probe
Beginning materials   600
   Maximum production = 960

Beginning workers employed   100
   20 leave, so 90 are effective

Beginning productive machinery   50
   Production =   638.42        Ending materials =    140.69

Hire/fire    30
% Overtime   15
   Production =   720.00        Ending materials =    101.11
```

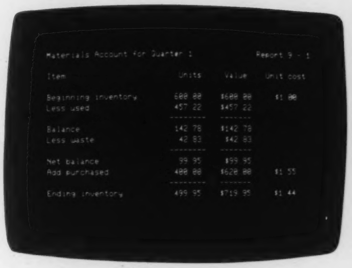
Corplan Mirrors The Real World

With Corplan, complex decisions must be made in the same manner in which they are made in the real world. For example, sufficient raw materials must be purchased to meet the next quarter's target output without wasting excess inventory—and without overcrowding available plant space or causing a cash shortage. Funds must be raised by issuing bonds or additional stock shares, or even through an emergency bank loan. Stockholders must be paid dividends. The corporation must create demand for its product through pricing and advertising. New plants must be ordered, sales people hired and fired, stock shares bought back and so on.

An Affordable Educational Asset

The Corplan program (Cat. No. 26-2619, $49.95) requires a 48K TRS-80 Single-Disk Model III or 4 (in Model III mode). An optional printer can be used to produce copies of the program's accounts and reports. Corplan includes a comprehensive user's manual that demonstrates a sample quarter and explains the program's calculations and situations. Planning forms that can be copied for use by each player or team are also included. For more information, visit your nearby Radio Shack Computer Center, participating store or dealer—or contact your Radio Shack Regional Educational Coordinator.

CIRCLE 209 ON READER SERVICE CARD



```
Materials Account for Quarter 1              Report 9 - 1

Item                             Units     Value   Unit cost

Beginning inventory             600.00   $600.00     $1.00
Less used                       457.22   $457.22
                              --------- --------
Balance                         142.78   $142.78
Less waste                       42.83    $42.83
                              --------- --------
Net balance                      99.95    $99.95
Add purchased                   400.00   $620.00     $1.55
                              --------- --------
Ending inventory                499.95   $719.95     $1.44
```

For the name of the full-time Educational Coordinator in your area, call Radio Shack's Education Division at 800-433-5682, toll-free. In Texas, call 800-772-8538.

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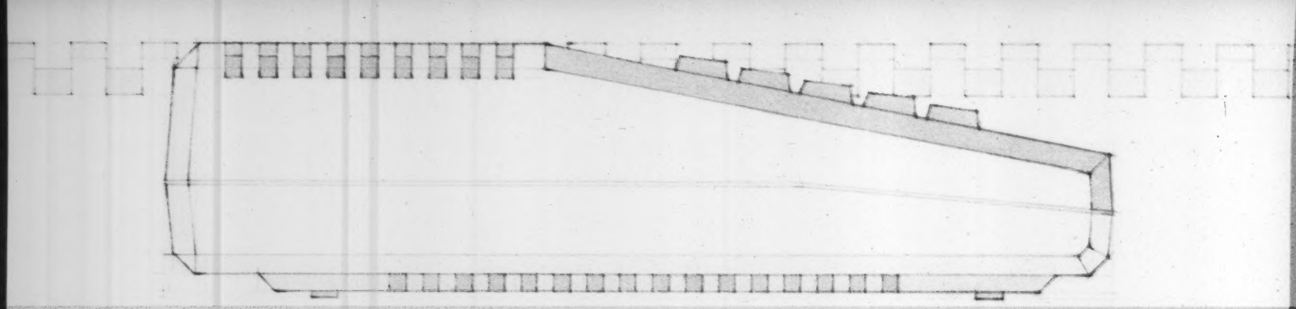

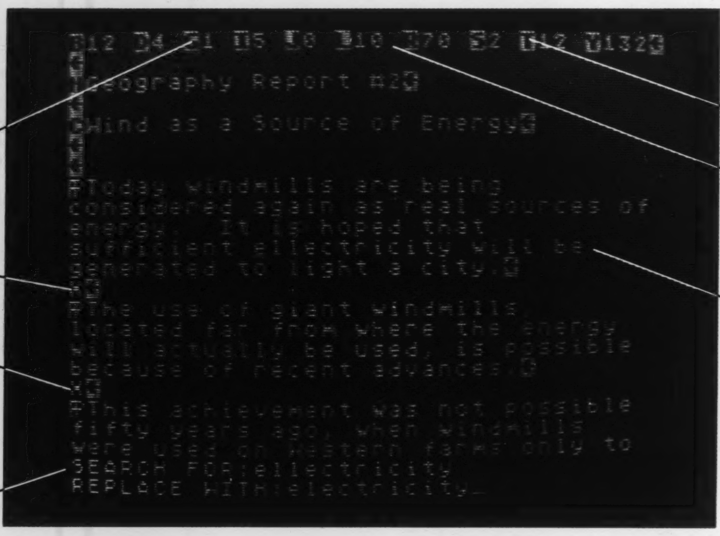

```
B12 D4 G1 I5 L0 R10 T70 S2 M12 Y132
Geography Report #2
Wind as a Source of Energy

Today windmills are being
considered again as real sources of
energy.  It is hoped that
sufficient ellectricity will be
generated to light a city.

The use of giant windmills,
located far from where the energy
will actually be used, is possible
because of recent advances.

This achievement was not possible
fifty years ago, when windmills
were used on Western farms only to
SEARCH FOR:ellectricity
REPLACE WITH:electricity_
```

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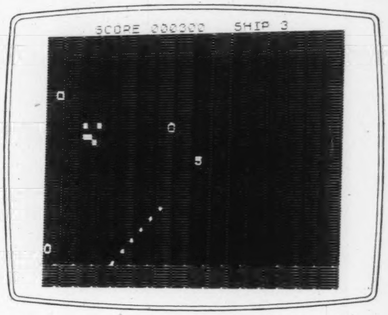
CIRCLE 105 ON READER SERVICE CARD

only six shots at a time. When you release the thrust button, your ship stops immediately. This gives good control.



Your ship may fly off the screen, but it wraps around to appear on the opposite side.

If you crash, there is no explosion. The game just pauses for a few seconds and then resumes. But be careful when you crash into a large meteorite; when it breaks up, one of the smaller fragments may hit you.

Meteorites are represented by 2 x 2 clusters of graphic characters. When you shoot one of them, you get 100 points, and it breaks up into four smaller meteorites, each worth 200 points and represented by a letter O. There is no high score indicator, and there are no flying saucers either.

creative computing

SOFTWARE PROFILE

Name: Meteorites

Type: Arcade

System: Timex Sinclair 1000 with 16K RAM.

Format: Tape

Language: Basic and Assembly

Summary: Fast, smooth graphics and a challenging game

Price: $14.95

Manufacturer:
Softsync, Inc.
14 E. 34th St.
New York, NY 10016

When all of the meteorites on the screen are destroyed, the next screen begins with one more large meteorite (up to a maximum of four). When your score reaches 10,000 points, you acquire another ship. When all your ships are gone, the game ends. Pressing 0 starts another game.

The graphics in this game are fast and smooth, due to machine language. The cassette loaded well. In extended play, however, the program seemed susceptible to crashes and some display distortion.

The game is challenging and always different. This program lives up to Softsync's standard and will not disappoint you.—*JG*

Merchant of Venus

In *Merchant of Venus,* you are a representative of the Galactic Trading Corporation. Your aim is to make a profit by buying and selling at the different space stations. You start out with 200,000 Solari.

First, you must buy a ship; you have ten freighter classes to choose from. The ship is inspected, and the number of damaged units, if any, is shown.

Next, you are given four options: trade, effect damage, transfer Illyrion (fuel), or commence launch.

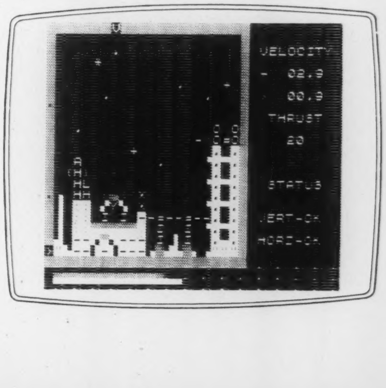
If you choose to trade, a list of the ten items is shown. The buying and selling prices at that trading base are given along with your cash reserve and an inventory of your cargo.

After buying fuel and other cargo, you may repair ship damage. If your ship has too many damage units, launch clearance will not be given. The last crucial decision before launching is to decide how much of your Illyrion goes into the reactor and how much into the store.

Each of the five bases has its own name and number, docking facilities, appearance, and prices for buying and selling. The docks are very complex. Along with an intricate view of the launching pad, towers, and other structures, the display shows other important data, a fuel gauge, and velocity indicators. Figure 1 shows the starting base Chryse and the data. When you are out of the range of the base, a wider view of the skyline passes, and you must watch for the next base. When you attempt a landing, the screen enlarges again. If you are going too fast, you can land, but your ship will suffer damage. After buying and selling, you are ready to launch to the next base. Soon you will learn which bases have the best prices.

At the end of the game a performance rating and repeat option are given.

The documentation is good, but lacking in some points, all of which can be cleared up by experimenting, e.g., it does not tell you that you should fly left unless you want to hit the hardest base first. The tape loaded well once the correct volume was found.



Merchant of Venus really combines two games into one: a lunar lander and a trading game. The lunar lander part alone is worth the money; I have not seen a more challenging TS1000 lunar lander game. The graphics are excellent and are not too slow, because there are many machine code routines. Add to this the merchant part, complete with unusual names to bring the game to life, and you have on of the best games on the market.

creative computing

SOFTWARE PROFILE

Name: Merchant of Venus

Type: Arcade

System: Timex Sinclair 1000 with 16K RAM.

Format: Tape

Language: Basic and Assembly

Summary: An excellent combination of a lunar lander and trading game; very challenging.

Price: $9.95 from Timex

Manufacturer:
Timex Computer Corp.
Waterbury, CT
and
Crystal Computing
50 Charles Close
Wroxham-Norwich
U.K. NR1 28TU.

This program is an excellent value for the money. It is very complex but easy to play. The authors paid incredible attention to detail without making the game too complicated.—*JG*

"I've done it, Higgins—I've created a video game that will accept Visa and Master Cards!!"

Warfare In Ancient Rome

Legionnaire

James V. Trunzo

The name Avalon Hill has long been synonymous with board wargames. Chris Crawford, the author of *Eastern Front 1941,* is known as an outstanding Atari programmer. It should come as no surprise, then, to find a successful effort being produced by the two in the form of *Legionnaire.*

The game places you, the player, in the role of Julius Caesar and places at your command between five and ten legions which are commanded by famous generals like Crassus or Cicero. The computer becomes a formidable antagonist, controlling a wide variety of barbarian infantry and cavalry who outnumber Caesar's legions by at least two to one.

creative computing

SOFTWARE PROFILE

Name: Legionnaire

Type: Computer wargame

Systems: Atari 400/800, Apple II

Format: Atari: Cassette 16K, Disk 32K; Apple II: Disk

Language: Machine

Summary: Excellent wargame/computer hybrid

Price: $35.00 cassette; $40.00 disk

Manufacturer:
Microcomputer Games
A Division of
Avalon Hill Game Company
4517 Harford Rd.
Baltimore, MD 21214

The game begins with a series of prompts asking you, as Caesar, to select the number of legions you wish to command and to select which two of the 16 barbarian tribes you wish to oppose.

The computer then places the opposing armies somewhere on the multicolored graphics map and awaits the start of combat.

Playing The Game

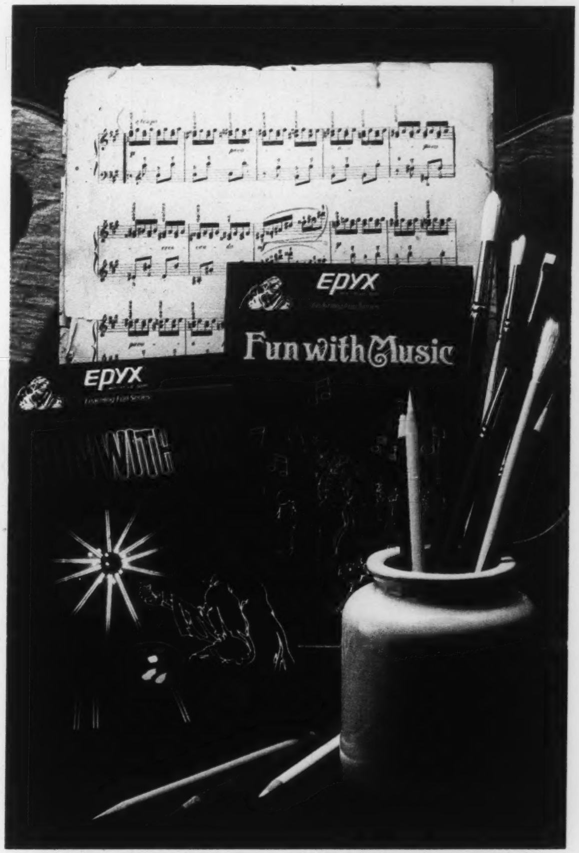
When you are ready to begin, you press START, and you hear the sound of marching as the barbarian host advances upon your current position. Because *Legionnaire* is a real time game, it is important that you begin issuing orders to your legions at once.

All commands and movement are entered with the joystick. By placing the cursor over any symbol, and depressing the button, you will be provided with the following information: the general in charge of that specific legion, the number of unwounded men available, and the effective fighting strength of the unit.

Orders are given by placing the cursor over a symbol, keeping the button of the joystick depressed, and moving the joystick in the direction you wish the legion

James V. Trunzo, RD 2, Box 376, Leechburg, PA 15656.

GIVE YOUR KIDS A LESSON THEY'LL NEVER FORGET.



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The second mode lets you play your song in a fun-filled action game. You control a drum major trying to touch the notes before a small but pesky poodle catches up to him and slows down the parade.

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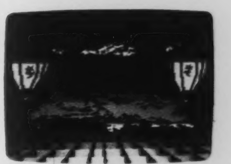

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to travel. Up to eight orders can be given at one time in any combination of horizontal or vertical directions. Orders can be given to all units at any time during the game. Furthermore, orders can be canceled at any time prior to the completion of a unit's movement by simply positioning the cursor over the selected unit and pressing the spacebar on the keyboard. One press on the bar cancels the last order given; two presses on the bar cancels the last two orders given, and so on. You can, of course, give orders only to your own troops. The artificial intelligence routines take care of all the details for the barbarians, and you will soon discover that your opponent is far from being a predictable victim.

Combat takes place when any unit attempts to enter an area occupied by an enemy force. Various sound effects highlight the conflict and signal the elimination of a Roman legion or barbarian unit. Sides take losses in relationship to the relative strengths of the opposing units and results can be monitored.

The game ends when either side loses all of its units or Caesar quits the game by pressing the OPTION key. In the former case, it should be noted that even if Caesar eliminates all barbarian units, his campaign may not be considered a success. If, for example, you wipe out the Gallic tribes but at the cost of most of your men, you will quite probably earn a negative score, indicating that you paid too high a price for your triumph.

If Caesar chooses to quit, the computer responds with a prompt to make sure the OPTION key was not pressed accidentally, thus safeguarding the game in play. A second pressing of the key, however, terminates the game.

As A Computer Game

From a computer gamer's point of view, *Legionnaire* succeeds in many areas. The graphics are well done and easy to identify, and the sound effects range from fair to good. In fact, the rhythmic marching, which gets louder and faster as an attack approaches, can be downright frightening. The terrain, though simple, is adequate in terms of graphic depiction, and the multi-colored bands that make up the informational area do much to offset the somewhat bland appearance of the predominantly green map.

Scrolling is accomplished quickly and smoothly; images are flicker-free, and the joystick-manipulated cursor is very easy to use.

As A Wargame

From a wargamer's viewpoint, *Legionnaire* offers many of the intricacies normally associated with the genre without the work involved in implementing them. To begin with, each barbarian tribe is unique. The offensive and defensive strength of each specific tribe, its ability to recover from an attack or its susceptibility to panic after an attack, and its style of fighting (aggressive, cautious, fanatical, disciplined, etc.) are all taken into consideration. Such factors as a tribe's speed, fatigue, and weakness to flank attacks also play an important part.

The artificial intelligence routines take care of all the details for the barbarians.

The Roman legions under your command are subject to the same factors, but are further affected by the capabilities of their commander.

Other familiar facets of wargaming taken into account by Crawford in *Legionnaire* include the effect of terrain on both offense and defense, the amount of time elapsed between movement of a unit and the launching of its attack, the advantages of positioning during combat (frontal, flank, and rear attacks), and the strengths and limitations of cavalry as opposed to infantry.

Don't let all of this overwhelm you; *Legionnaire* does not require a degree from a military academy to play and enjoy. Keep in mind that the computer does all the work and allows you to concentrate on basic strategy. Indeed, as wargames go, *Legionnaire* does not earn even an average complexity rating. Yet, that's the beauty of the game. It is challenging, but simple to play.

The many combinations that can be achieved by varying both the numbers and types of combatants assure that *Legionnaire* will not become predictable or boring. Furthermore, *Legionnaire* will not bog you down for hours, moving hundreds of counters across acres of game boards; a game takes from fifteen minutes to an hour and a half, depending upon the number and types of forces selected for play.

Now if you'll excuse me, the Helvetti infantry are manhandling poor ol' Flavius; and the Belgae cavalry are bearing down on Galba's flank. It's Caesar's tenth legion to the rescue.

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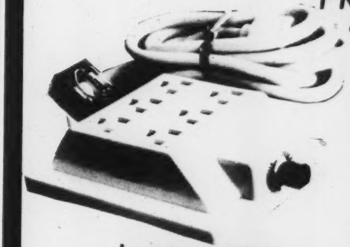

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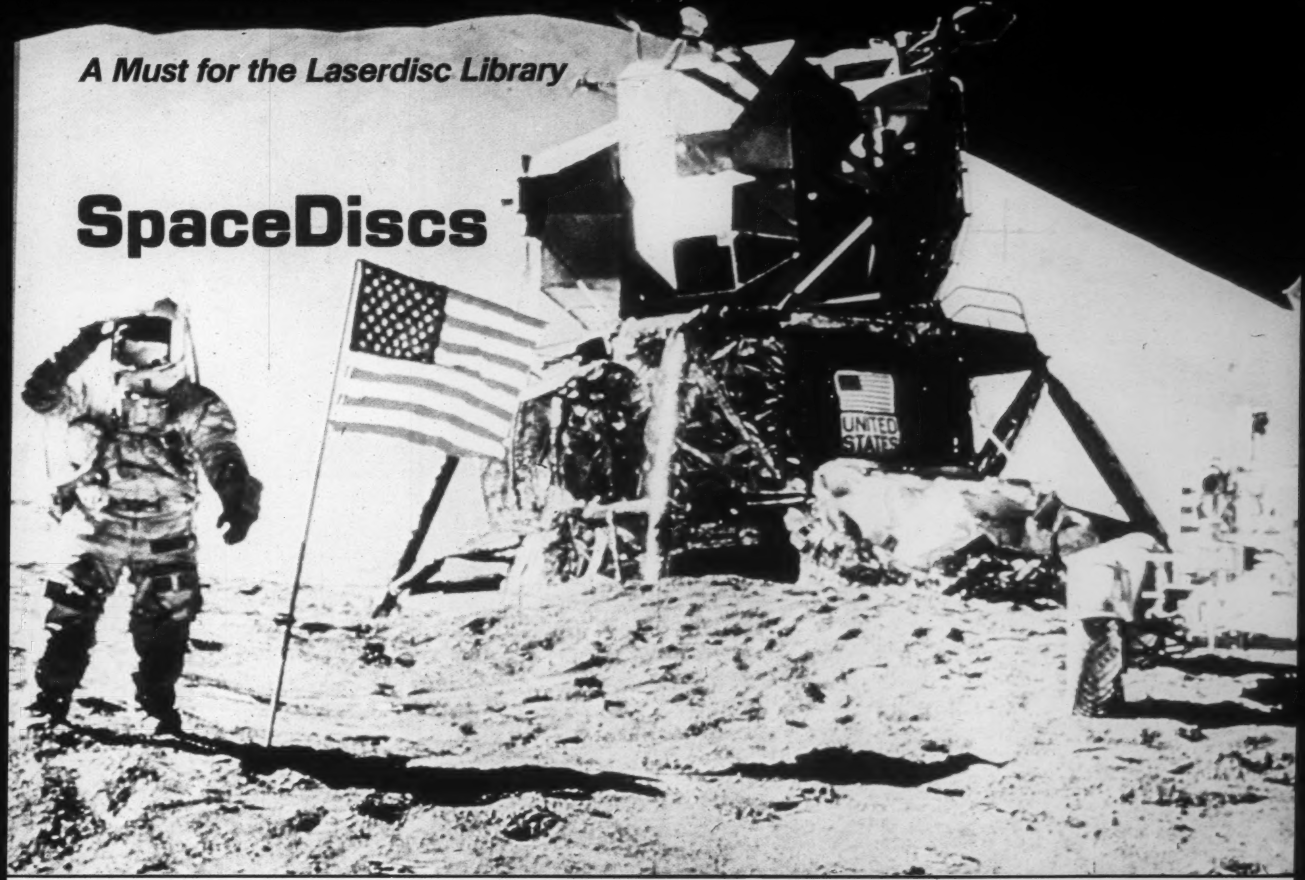


The classic photo of planting the American flag on the moon on the Apollo I mission is one of some 10,000 frames on the Apollo SpaceDisc.

John J. Anderson

Why can I so clearly recall long evenings with nothing on the tube but reruns and car chases—and reruns of car chases? Perhaps the memory is vivid owing to the chronic nature of the condition. Lamenting, I rhetorically and ritualistically ask myself the same questions. What about the moon shots? What about Voyager? Why don't they ever show *that* stuff?

Well maybe *Laverne and Shirley* get higher ratings around your place, but my idea of entertainment is imagining how it might have felt to use a seven iron on the Sea of Tranquility. Show me views of the earth as seen from the Shuttle. Give me some background on the incredible efforts that resulted in the Apollo and Voyager programs. Remind me of the raw awe I felt before I and the rest of this jaded country grew so blase about the whole thing.

With the exception of a rare program on public TV, those views have remained a pipe dream, until quite recently. Now with a home VCR, you can look at the moon shots whenever you want.

But can you review stills of Cape Cod as viewed from orbit? Can you freeze the frame clearly whenever you want to? Can you scan thousands of computer-eye views of Saturn for details the scientists have missed? Can you look at nearly every shot in every magazine of film shot during a mission? Now, with a laserdisc player, you can. "Right in the privacy of your own home," as they say. Whenever and however you want to.

Prepared by the Center for Aerospace Education at Drew University, *SpaceDiscs* are a collection of six laser video discs that chronicle the space age in painstaking detail, thanks to the archives of NASA Cape Canaveral and the Jet Propulsion Laboratory in Pasadena. All space program buffs, all laser disc buffs, and I should think most of the average populace, will savor the contents.

Where were you the night Neil Armstrong bounced down the ladder of the lunar module and pressed the first human footprints into the lunar dust?

The Apollo disc, as an example, contains virtually every still shot and film magazine any astronaut ever clicked off during the Apollo 11, 12, 14, 15, 16, and 17 missions. I well remembered that we landed on the moon, but had not clearly recalled that we did so six times.

Where were you the night Neil Armstrong bounced down the ladder of the lunar module and pressed the first human footprints into the lunar dust? The Apollo Space Disc will jog your memory. Remember the lunar rover? Motion pictures taken from its front bumper constitute some of the most impressive shots of any mission, and some of the most amazing tracking shots ever taken.

All of these clips and photos and thousands more are present on the Apollo disc. There are segments on the design and preparation of Apollo, from initial design to astronaut training and simulation. Remember the massive, disposable Saturn V? Its sheer size was impressive.

Each disc comes with a paperback "image directory," detailing every still and film clip on the accompanying disc. On the Shuttle disc, photographs of Earth's terrain occupy most of the stills. They are fascinating. Turn the lights out and imagine you are looking out the viewport of the Challenger. Then bring her in for a landing, with a pilot's eye view from the cockpit. Or ride in the chase plane, if you wish.

The Laserdisc As Learning Tool

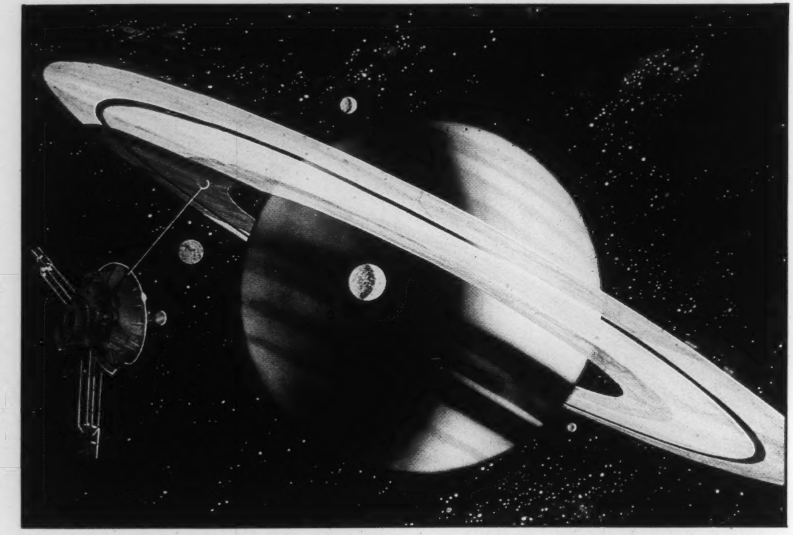
This series underscores the true facility of the laserdisc player as a learning tool. Because each individual frame can be frozen as a clear, high quality still, thousands of still photographs can be reproduced for examination. Because the player can automatically access any designated frame, it can act as a random access device. And because interfaces are available, a disc player can be controlled by a microcomputer or tape recorder. The possibilities can start you thinking, eh?

With the possible exception of new disc-based video games, I have not seen any discs which better demonstrate the capabilities of laser video technology than *SpaceDiscs*.

Discs Available

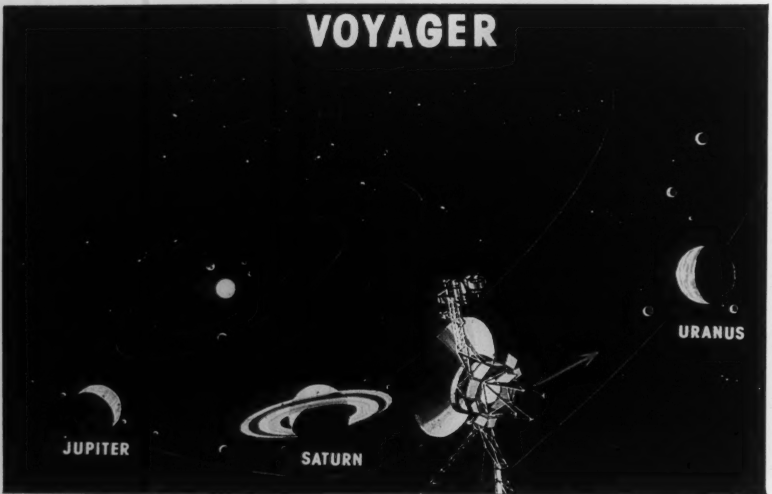
The six discs currently available include the following:

- *Voyager*: General information movies, seven computer-generated mission profile movies for Jupiter, Saturn, Uranus, and Neptune encounters; spacecraft development; assembly and launch photographs; descriptions of all 11 experiments and a summary of their results; comprehensive coverage of the imaging science experiment, with 16 data animation movies of the rotation of Jupiter; the red spot, Saturn and Saturn's rings, physical scale and USGS topographic maps for many of the objects encountered.



The four computer animated segments on the Voyager SpaceDisc show "close ups" of the mission of both spacecraft at both Jupiter and Saturn. It is fascinating to compare these computer-generated sequences with the actual images from the missions later on the disc.

- *Apollo*: Approximately 10,000 NASA photos and film clips of the successful Apollo landings; astronaut training; spacecraft preparation, launch, docking sequences, mission, and recovery.
- *Shuttle*: Approximately 3400 NASA photos of STS development and onboard photography from STS 1, 2, 3, and 4; development movies, including propulsion test firing and approach and landing test; launch, ET separation and out-the-window views of launch and landing; staging, views from orbit, cargo bay, manipulator arm experiments and cabin interior; landing video from chase planes.



The Voyager SpaceDisc contains a computer animated segment that shows the flight of the two Voyager spacecraft past Jupiter and Saturn, and on to Uranus.

Turn the lights out and imagine you are looking out the viewport of the Challenger. Then bring her in for a landing, with a pilot's eye view from the cockpit.

- *Astronomy*: Pictorial glossary of all solar system bodies (poor telescopic to best spacecraft); planetary exploration by spacecraft, including complete still and movie coverage of Mariner Mercury, Pioneer Venus, Ranger, Surveyor, Lunar Orbiter, Viking, Pioneer Jupiter/Saturn, Voyager Jupiter/Saturn and Galileo; collection of solar stills from different observatories; Skylab, movie clips of sunspots, prominences, flares, rotation and eclipses; photographs of observatories and collections from their archives; glossary of deep sky objects, including Messier catalog and atlases of galaxies; "movie clips" of big bang; computer-generated formation of galaxies, stellar evolution, pulsars, and black holes.
- *The Space Age*: Stills of NASA launch record, including mission description, launch vehicle, payload, and recovery dates; highlights of onboard photography

from Mercury, Gemini, Apollo, Skylab, Shepard, Glenn, Kennedy speech, Ranger lunar impact, White spacewalk, Gemini rendezvous, Apollo 8 lunar orbit, Apollo 11 landing, Armstrong step, Skylab repair, Mars landing, Skylab and Shuttle experiments; design and development.

- *Geoscience*: Solar system geology; terrestrial geoscience; plate tectonics; vulcanism; surface features; rock studies; lunar sample and meteorite studies; comparative planetology; crater studies; U2 high altitude photography, including 100 largest American cities; Gemini, Apollo, Skylab, Apollo/Soyuz earth-looking photography; selected LANDSAT coverage.

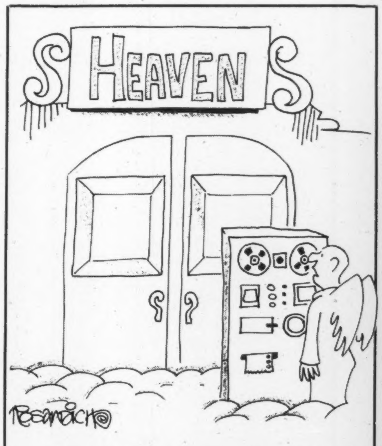
If money is no object, I highly recommend the SpaceDisc series.

As you can tell, the *SpaceDiscs* series was designed to be very comprehensive—the most comprehensive single-medium collection of space science materials ever assembled.

There is a hitch: the discs are expensive. They are priced at $320 each or $1600 for the set, and so are geared for the educational market. It is possible that a lower priced home market album of discs may be released at a future date.

If money is no object, I highly recommend the *SpaceDisc* series. If you are balking at the price, think of how much it might cost if a moonrock were included. For some of us, *SpaceDiscs* will come as close to a trip into space as we are likely to get. And compared to the cost of a ticket on the Shuttle, it is a positive steal.

For more information contact Video Vision Associates, 39 East 21st St., New York, NY 10010. (212) 777-4108. END



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In-depth playtests of 11 new joysticks and game controls.

creative
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CONTROLLER UPDATE

David H. Ahl

We have been seriously evaluating game controllers since Cromemco brought out the first computer joystick in 1977, long before there was an Atari VCS or the profusion of video and computer games that exists today.

Over the years we have seen a steady evolution and improvement in controllers as manufacturers learn from the mistakes of their predecessors and respond to the desires of the market.

However, along the way, we have also seen a few products brought out for the sake of technology itself (if it can be done, it must be good), or for the sake of novelty (if it is different, people will buy it).

We generally like to be upbeat and report that everything new is truly wonderful, but this issue we have some entries from all three of the above categories.

Some of the products reviewed below incorporate evolutionary changes and represent improvements in the state of the art, but some are technology for the sake of itself, or novelty for the sake of being different.

Joysticks

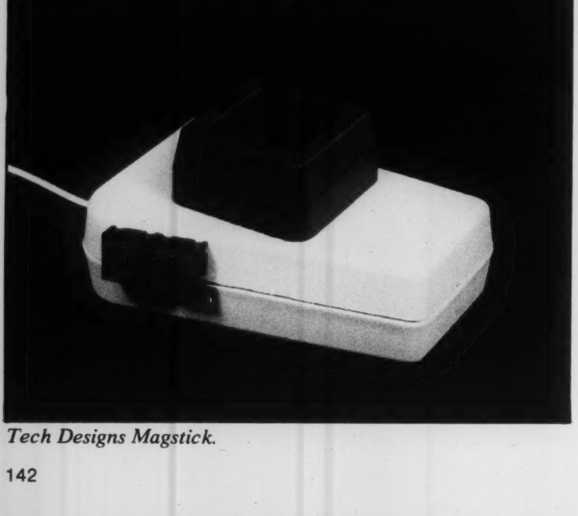
Tech Designs Magstik (for Apple)

We gave our top rating to Tech Designs' Adam and Eve paddle controls for the Apple computer almost two years ago, and to this day they remain our personal favorites. They have the right size housing and knob, a responsive firing button, and are very accurate.

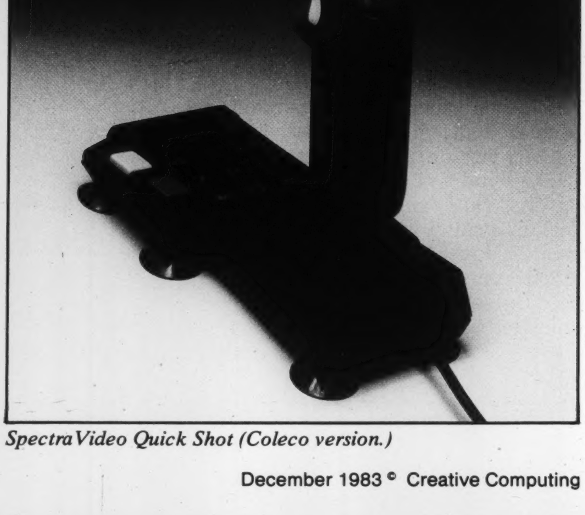
Shortly thereafter, Tech Designs introduced a joystick of which we never obtained a sample for review. However, they now have introduced a new joystick with a rather interesting design.

Most joysticks are either self-centering (good for maze and Pac-creature type games) or non-self-centering (good for *Missile Command* and *Centipede* type games). The few joysticks on the market that allow self-centering to be defeated do so by means of a mechanical arrangement that involves either unhooking some springs manually or adjusting small levers in the base of the control housing.

Tech Designs has a better idea. The Magstik has a magnet attached to the bottom (enclosed) part of the joystick



Tech Designs Magstick.



SpectraVideo Quick Shot (Coleco version.)

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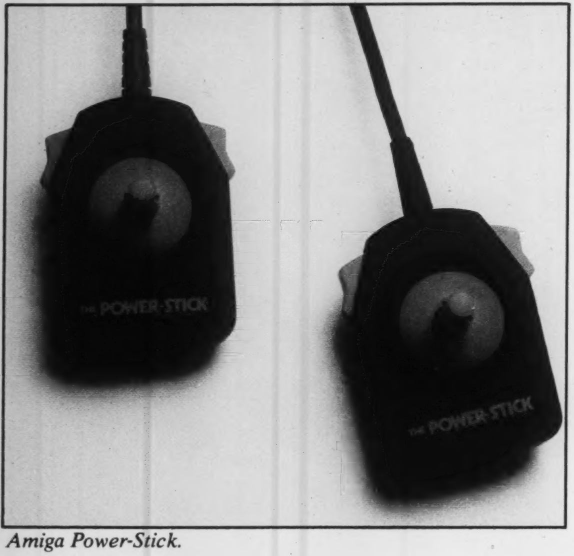
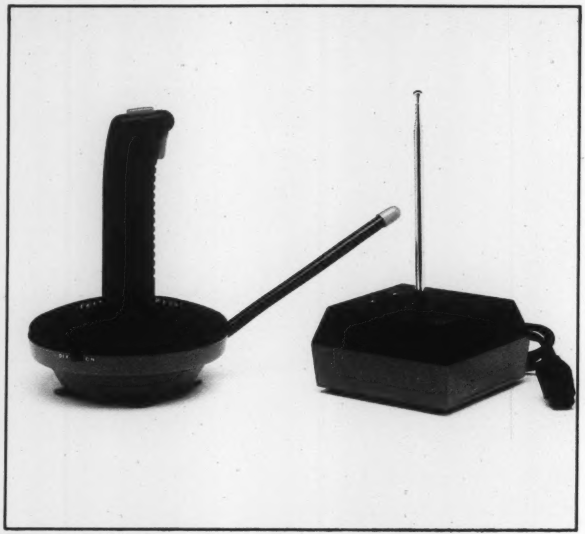


Amiga Power-Stick.



Championship Super Champ Remote.

and a second magnet in the bottom of the housing. When both magnets are in place, the joystick is self-centering. However, when the module containing the housing magnet is removed, the joystick is free-moving. No springs. No lever switches to foul up.

We can't hide our enthusiasm for the Magstik. The feel of it in the non-self-centering mode is amazingly smooth and responsive. But the same is true of the self-centering mode. Gone is the "clunk" as the springs tug the stick back to the center position.

Moreover, the Magstik has a centering adjustment on each direction of the stick which permits you to fine tune the stick to whatever game you are playing.

The two firing buttons are the same responsive ones used on the Adam and Eve paddles. They are side by side on the upper left side of the housing. We are not enthusiastic about that location for the buttons since it is very difficult to get two fingers on them simultaneously. Indeed, it favors lefties who can get the forefinger and middle finger of their right hands on the buttons. Righties will have a more difficult time with games such as *Sea Dragon* which require quick action from both firing buttons.

Nevertheless, we judge the Tech Designs Magstick to be one of the best, if not the best Apple joystick we have tested. Suggested retail is a pricey $64.95, but if you are serious about your games, it is easily worth it.

For more information, write Tech Designs, Inc., 3638 Grosvenor Dr., Ellicott City, MD 21043.

SpectraVideo Quick Shot (Atari-compatible; ColecoVision version available also)

Did you read the sections on Mastering Atari VCS games in the last issues of *Video & Arcade Games*? Martha Koppin uses a SpectraVideo Quick Shot joystick. However, this is one of those odd situations in which we have been using a product for ages, but never got around to telling the world how much we like it.

The Quick Shot has a handle contoured to a full hand grip. For games like *Star Raiders* you can wrap your whole hand around it and fire away with the button on the top of the stick. But for games like *Shamus* that require a more sensitive touch, you can grip the top of the handle like a normal joystick and use the firing button in the base housing. Actually, we find ourselves going back and forth, using both the firing button in the handle and the one in the base.

The firing button in the base is normally at the top left corner of the housing, favoring righties who control the stick with their right hand but fire with their left. However, a unique design allows the handle to be rotated 90 degrees which puts the button at the top right for lefties.

The molded plastic housing is rounded so it won't leave a lasting impression on your hand if you are holding it with the usual tension built up in playing video games. However, Quick Shot comes with four removable suction cups that fit in the housing and fasten the unit firmly to a desk or table if you have one handy.

Quick Shot has an extra long cable so players need not be crawling over one another to get close to the computer or game system—a thoughtful touch.

Do we sound enthusiastic about Quick Shot? You bet! It is one of the best joysticks on the market and the price is a very reasonable $12.95.

You'll find Quick Shot at most dealers, or write SpectraVideo, 39 W. 37th St., New York, NY 10018.

Amiga Power-Stick (Atari-compatible)

A most unusual joystick is the Amiga Power-Stick. First of all, it is small, measuring a diminutive 2.5" x 1.7" x 2.2". Second, this is a true fingertip controller—you can't grip the handle with more than two fingers.

In its favor, Power-Stick has two very responsive firing buttons located on the upper left and right sides of the housing. Righties and lefties will find one of the buttons falls naturally to either a thumb or forefinger, whichever you favor.

The stick itself is ultra-responsive, too much so for some of the members of our playing panel who favor a full-fisted control like the Quick Shot. Indeed, the self-centering feature seemed to be completely absent unless the control was treated quite gingerly. On the other hand, some players found the control gave them good precision and speed. Moreover, no one complained of fatigue after using the Power-Stick; its touch was so soft. As the instructions suggest, "a light, quick touch is most effective."

Because of its small size, Power-Stick is strictly a hand-held control; there is no provision for anchoring it to a table. It is equipped with a long six-foot cord.

For more information, write Amiga Corp., 3350 Scott Blvd., Bldg. 7, Santa Clara, CA 95051.

Championship Electronics Super Champ Remote (Atari-compatible)

You will recall in our last roundup, we were most enthusiastic about the Super Champ joystick from Championship Elec-

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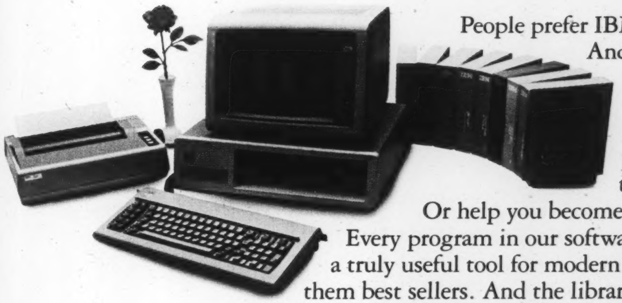

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4
5
prostick II

Newport Controls Prostik II.

Wico Boss.

tronics. It is a tall stick, but remarkably sensitive to the touch, requiring just a tad over 1/4" movement at the top of the 5" handle to activate the contacts. With two firing buttons in the handle, one on top and one in the front, we judged it one of the top Atari-compatible joysticks that we had tested.

Now Championship is offering the Super Champ in a remote control configuration. A miniature transmitter is housed in the base of the joystick replacing the long 10-foot cable and wind up mechanism in the normal version. A second, receiver unit is located by the video game or computer. Thus, you can sit across the room and move about while playing your favorite game.

Naturally, you will still have to get up to activate the switches on the game console or computer to start a new game and select options and skill levels, but the rest of the time, you are free to move where you wish.

For more information, write Championship Electronics, 711 Grandview Dr., South San Francisco, CA 94080.

Newport Controls Prostick II (three versions: Atari-compatible, Coleco, and TI)

As we pointed out in a previous issue, Newport Controls is a manufacturer of high-quality replacement controls for arcade games. Their first joysticks for the home market were simply rugged arcade game controls put in tough plastic housings. We loved the joystick, but found the firing button of lesser quality. Nevertheless, when they first came out, they were so much better than anything else on the market that we gave them a glowing endorsement.

No grass is growing under the feet of the folks at Newport, and they have introduced the second generation Prostick in three versions: Atari-compatible, Coleco, and TI. Here is Sherrie Van Tyle's report on the TI version.

No tears were shed when we unplugged our standard TI joysticks to test the Prostick II, an arcade-style unit for the TI 99/4A. With the Prostick, players jubilantly eluded missiles in *Parsec* and zipped around corners in the *Munchman* maze, bettering their old scores by thousands of points.

Compared to the TI joysticks, the Prostick feels solid in the hand; the base, solidly built of molded blue and black plastic, tapers to 3" for a snug fit in the palm of the hand. The Y-adapter, which enables the Prostick to replace the TI joysticks, doubles as a cable splitter so that two Prosticks may be connected for two-player games.

Players particularly liked the switchable gateplate—a black plastic collar around the stick that locks out diagonal signals for superior maze gameplay. Once the gameplate is switched from eight directions to four, it remains firmly in place. The six-foot cord is long enough to reach a player's favorite floor cushion or chair.

Two responsive firing buttons on the front of the housing round out this excellent joystick.

The Coleco version comes with a Y-adapter to allow the Prostick and Coleco controller to be plugged in simultaneously. The Atari version is identical, but has no adapter.

For more information, write Newport Controls, Bishop, CA 93514.

Wico Boss (for Atari and TI)

In our last issue, we sang the praises of the Wico Command Control and Red Ball joysticks. Now, they have augmented their line with a controller called the Boss. We tried the TI version. Here is Sherrie Van Tyle's report.

Side by side, the Boss joystick from Wico dwarfs a TI controller. The Boss is built to withstand years of gameplay with a hefty 4" square base of molded plastic and a stick that is 4" long. In shoot-'em-ups and *Frogger*-type games, the Boss easily outperforms the TI unit.

The stick and the fire button respond fast. Some players complained, however, that it was difficult to move the stick and fire simultaneously. Children thought the stick was too large in circumference for a comfortable grip. The base is meant to rest on a tabletop, though no suction cups are attached to the bottom, because the unit cannot be held in the hand for long without strain.

In addition, players felt that the lack of a gateplate to lock out diagonal signals during maze games was a drawback. Despite these complaints, players who tested the Boss topped all the scores they had achieved with TI joysticks.

The Boss offers a significant improvement over the stock TI joysticks. The price is $19.95, but it requires a TI adapter

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which costs $12.95 from Wico. A less expensive adapter, the Champ #2, for $4.95 from Championship Electronics can also be used.

For more information, write Wico, 6400 W. Gross Point Rd., Niles, IL 60648.

Other Game Controllers

Suncom Joy Sensor (Atari-compatible)

The Joy Sensor is described by the manufacturer as a "touch-sensitive joystick simulator." Looking more like a remote control for a TV set, the Joy Sensor measures 6.5" x 3" x 0.8" and has two touch-sensitive surfaces, one each at the top and bottom of the unit.

JOY-SENSOR
TOUCH SENSITIVE
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Suncom Joy Sensor.

The surface at the bottom is a circle 1.75" in diameter. It has eight directions marked on it corresponding to the eight ways a joystick may be moved. For maze-type and other games requiring movement in just four directions, a slide switch in the center may be moved to the left to lock out the diagonal directions. A rectangular surface at the top has two standard firing controls at each side and a rapid fire sensor in the center.

Suncom recommends holding the Joy Sensor in one hand and using the opposite thumb to control direction on the touch panel. Firing is controlled by the thumb of the hand holding the unit. Suncom warns that, "it may take a while for you to learn how to best use your Joy Sensor, but once you do, you won't want to stop." Well, maybe.

None of the members of our playing panel were particularly thrilled with the Joy Sensor, and game scores suffered badly when using it. There is no question that it is fast and responsive, but none of us ever quite got the hang of it.

The best feature is the rapid fire button which assures long survival in games like *Defender*—holding the button down makes you practically invulnerable. Now if only we could maneuver, too.

For more information, write Suncom, 650 Anthony Trail, Suite E, Northbrook, IL 60062.

Amiga Joyboard (Atari-compatible)

Remember those indoor skiing simulators that were at all the ski resorts in the 60's, but that never quite caught on? Well, Amiga has designed a similar device that works with an Atari VCS (or similar system). It even comes with a skiing game, *Mogul Maniac*!

The Joyboard looks something like a bathroom scale, but the whole thing (including you) is balanced on a central disk that rests on the floor. It is not difficult staying balanced, although the tendency is to lean more to one side or the other, thus activating the contacts in that direction.

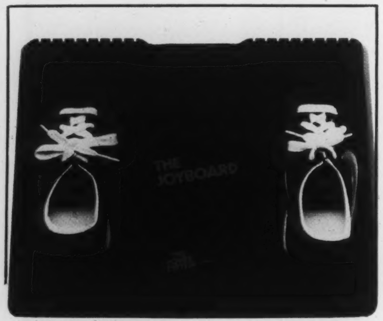
But that is what it is all about. Rocking the Joyboard activates the contacts in the direction that you lean. The Joyboard has eight-direction capability; because of this we sometimes found it difficult to activate just one side direction alone.

While Amiga claims that "the Joyboard works with almost all Atari-compatible video games," that doesn't mean that the games are truly playable with the Joyboard. It is fun to try other games just for laughs, but we think you will want to play mainly the four Amiga games designed specifically for use with the Joyboard.

These games include *Mogul Maniac*, a skiing game with nine downhill courses; *Surf's Up*, a surfing game; *S.A.C. Alert*, a fighter pilot flying game; and *Off Your Rocker*, a bop-the-mole type of game with colors instead of moles.

The Joyboard has a long 10' cord and is said to support up to 250 pounds (we tried it with 210 pounds with no ill effects).

Obviously, this is a specialized game controller and not a replacement for a regular joystick. It is good fun, particularly at a party, and may be the next addition for your game room.



Amiga Joyboard.

Adapters and Accessories

ECS Atari-to-Apple Adapter

Electronic Control Systems has introduced a black (er, tan) box that allows switch-type (Atari-compatible) joysticks to be plugged into an Apple computer.

This is not the first device of its type. The Sirius Joyport did the same thing but required special programming to use a switch-type joystick. Several companies offered games with a Joyport option for about a year, but few new games have been released for it.

Unlike the Joyport, the ECS device makes a switch-type joystick look like a potentiometer to the computer—well, not a full potentiometer, but three positions (full clockwise, center, and full counterclockwise). A knurled rotary control on the side of the box adjusts the resistance of the center position.

ECS Adapter.

Such an adapter makes it a joy to play maze games like *Pig Pen* and *Snack Attack*, as well as other games requiring movement in four directions. We were most enthusiastic about the essentially-similar Wico and Astar adapters and judge this one to be equally good. Incidentally, we also judge it to be vastly over-engineered. The Astar adapter uses five resistors, two mini pots, and two DIP relays whereas the ECS unit uses no less than 16 ICs, 14 resistors, 5 capacitors, 2 mini pots, and several diodes. But it works well, and that's the important thing.

For more information, write Electronic Control Systems, 22000 Romar St., Chatsworth, CA 91311.

Sullivan Enterprises Command Stand

The Command Stand is, as its name implies, a stand for a game controller. It has an 8" x 10" clear acrylic base that sits on the floor. Attached to the base is a two-foot red tube, on top of which is a sloping surface for mounting a joystick or paddle controller.

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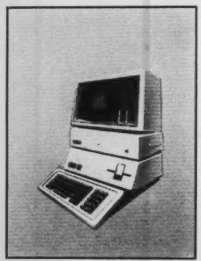

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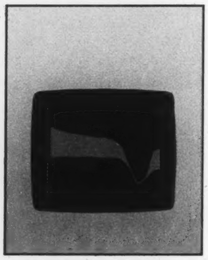

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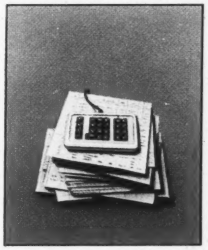

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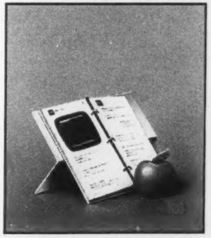

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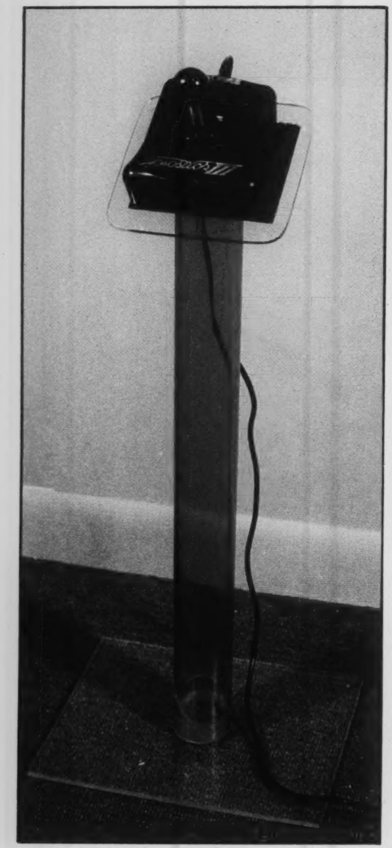
Controller Update, continued...

Included with the Command Stand is a package of adhesive-backed Velcro strips that must be applied to the bottom of your controller. Enough strips are included for two controllers. When the strips are applied, the controller is placed in the desired position on the loopy fabric which covers the sloping top surface of the stand.



Sullivan Command Stand.

To use the Command Stand, you simply place it between your legs with your feet on the base, and use the joystick as you would use one on an arcade game. Just one problem— the stand is only two feet high and, if you are sitting in anything higher than a kindergarten chair, you will have to lean well forward to grip the controller. This is not a disastrous shortcoming, but we would have liked the Command Stand far more if it was about 30" high. Smaller people (like children) found the height more convenient.

Nevertheless, the Command Stand is a nice idea and you may find it suits your playing style better than it did ours. Price is $39.95 plus $3.00 shipping from Sullivan Enterprises, 5714 Holland Lane, San Jose, CA 95118.

Have A (Trak) Ball

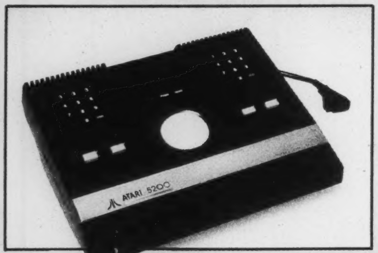
Owen Linzmayer

Without a doubt, the most distressing feature of the Atari 5200 is the lack of a quality controller. The potentiometer-style joystick that comes with the system has too many problems.

A contact at Atari has revealed that the return rate of the joysticks is in excess of 25%. Some of the most common complaints about the controller are that the response is slow, the rubber boot wears out, the plastic knob comes off, and that the stick is not self-centering. Now there is an alternative: the Atari 5200 Trak-Ball.

First introduced into arcade halls on games such as Football, Missile Command, and KickMan, the track ball quickly became a favorite among players. It offered a different feel, quick response, and a new dimension in control. Not until recently has a track ball been produced for home use, however. The 5200 Trak-Ball has all of the traits that made the coin-op controllers popular.

A track ball (generic name) is a device that can control both horizontal and vertical movement. The housing is built around a smooth sphere. About half of the ball is exposed on the top of the controller. The player places his hand on this part of the ball and spins it to produce movement of elements on the game screen.



Inside the 5200 unit, a white ball about the size of a billiard ball rests upon two rollers. When the ball is spun, friction causes the rollers to turn. Attached to the end of each roller is a wheel that has small "windows" spaced evenly on the outer rim. As the ball spins, the wheel turns, and two light sensors are activated as the windows pass in front of them. Using special logic chips, the blips detected by the sensors are converted from digital to analog signals. The Trak-Ball senses the speed and direction of the ball and relays this information to the 5200 master console.

Physically, the Trak-Ball is designed to complement the sleek looks of the 5200 system. The housing is made of a combination of black plastic and silver trim. The unit measures 11″ x 9″. At the back, the Trak-Ball is 3 ½″ high, but the panel slopes down to 1 ¾″ in the front.

The Trak-Ball has a 12-function keypad on each side of the white ball. Like the joystick, the Trak-Ball accepts keypad overlays. Directly below each keypad are two red action buttons that provide tactile response when pressed. Above the ball are three recessed rubber buttons: START, PAUSE, and RESET.

The cord from the Trak-Ball unit to the 5200 nestles underneath the Trak-Ball when in storage. You can unwind as much of the cable as you need, leaving the rest neatly tucked out of the way. The controller works best when firmly placed on a level surface, but it can also be held comfortably in your lap.

All 5200 games are not compatible with the Trak-Ball. *Pac-Man,* for instance, works only with a joystick. Other games such as *Galaxian, Missile Command,* and *Centipede* benefit tremendously from the use of a Trak-Ball. Check the cartridge box to determine whether the game can be played with the Trak-Ball.

The key to the success of the Trak-Ball lies with the software written for it. Unless the game programmer takes full advantage of the many features of the Trak-Ball, the game plays poorly. This gives the player the false impression that the Trak-Ball is not a good controller, when in reality, it is an excellent piece of hardware and the software is at fault. Two examples: *Football* and *Defender.* These games play better with a joystick because the Trak-Ball was programmed to leave a large "dead zone" in the center to simulate a joystick.

Until the Trak-Ball arrived at our office, the 5200 received only a moderate amount of attention. Now with an improved controller, it has become one of the most popular systems we have. *Centipede* was awkward to play with a joystick, but the Trak-Ball makes it as great as the coin-op version. The response of staffers to the Trak-Ball is overwhelmingly favorable. The designer of the 5200 Trak-Ball deserves a medal. For the cost of this peripheral—only $79—he has turned the 5200 into a truly super gaming system.

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The First Program

What To Do After You Read The Manual

Stephen Kimmel

You have been told how easy it is to write useful programs on your new $200 Goshwow personal computer. Being a good person who always brushes after every meal, you dutifully worked your way through the Basic instruction book—maybe two of them.

You are confident that you can unravel the secret meaning of any command. You are ready to try a real program. Something worthwhile. Something that will prove to your spouse that you didn't waste that $200. So you sit down at your machine, and you stare at the blank screen. The word READY has never had such an ominous look to it before. No brilliant programming pours forth from your fingers. You know, somehow, that you have done something wrong.

The books told you what all the commands and functions do. They told you what was legal and what was illegal. Programming is a great deal more than knowing the commands and error statements. But most books don't tell you that. They don't tell you how to go about the task of writing a major piece of software. This article presents one logical approach to organizing that job. I will walk you all the way through a program. We will start with an idea and finish with a working program.

By the time we are done, we will have a pretty good set of documentation as well. There will still be room for improvement in the program and our documentation won't be especially beautiful, but that is true of almost all programs. Once you have followed the steps a few times on your own it will be as natural as zapping Klingons.

Thinking Logically

Programming is a discipline of logical thinking. The computer is supremely logical if slightly misguided. It assumes that you know what you are talking about and does exactly what you tell it to do exactly as you tell it to do it. You won't make much progress persuading a machine that would make a tadpole look like Einstein unless you think the project through completely before you start programming.

You must approach a computer program in a logical manner.

For the new programmer this is a new experience. We are used to dealing with people who are capable, for the most part, of figuring out what we mean and filling in gaps and inconsistencies in what we say. The computer can't do any of that. You must approach a computer program in a logical manner. You must think logically. It is simply a matter of practice. You can do it. The problem is surviving the panic and uncertainty of the first program.

The key element, then, is the organization of the task. If you had a very good programming instruction book, it told you that one of the most important aspects of writing any computer program is writing the documentation. Documentation is a word that makes some programmers visibly ill. It is the part of programming that is the least fun.

You write out the meanings of all of the variables, explain the functioning of the various routines, and generally explain how the program works and how the user should use it. Doesn't sound like a lot of laughs, does it? The problem that most programmers have with documentation is that they put it off until the very end. Then it is simply required drudgery.

Their approach to documentation is illogical. You must work through the entire program in a logical manner at least once when you do your documentation. If you put it off until the end, you have to do it twice; once when you design the program and once when you write the documentation. If you do it first, or at least start it first, it will make writing the program much easier.

Writing a major piece of software is a question of thinking the matter through in a logical order, of organizing the task, and of breaking the job into manageable portions. All of that can be done by working out the documentation before you start programming.

Not all of these steps are directly related to writing the documentation, but they will carry you through to a program that will do the job. So let's get down to business.

Step One

Get an idea and decide what you want to do. Certainly that much is obvious. It doesn't have to be a big idea. Little ones are just fine. By the time we are finished, even a little idea may have grown into a major program. Even something as trivial as balancing your checkbook can become a major worthwhile program if you allow it to grow. It will do so if you allow your imagination to work on it.

Stephen Kimmel, 4756 S. Irvington Place, Tulsa, OK 74135.

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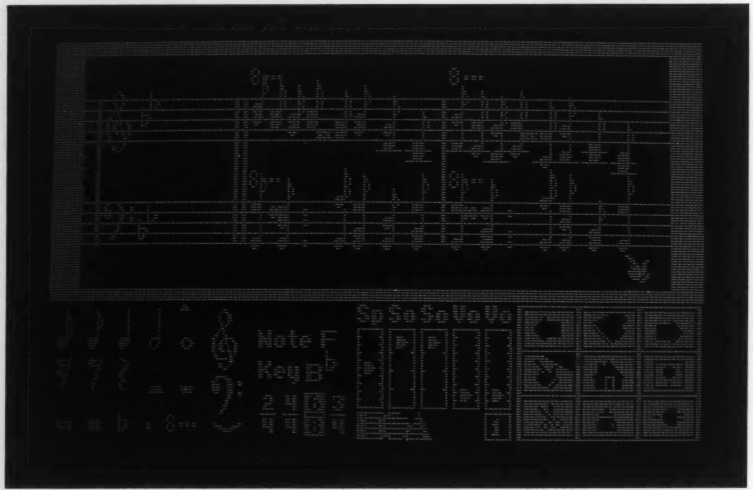
Take a good look at this screen because it, you, and a joystick are the whole story here.



That's you at the right end of the staff of notes — the little hand. Move the joystick, and you move the hand. Use it to carry notes up to the staff. Lay in rests, signatures, clefs, then point to the little piano in the lower right and listen, because you'll hear the whole thing played back.

Move those little scales in the middle up and down to vary the music's speed, sound quality, and volume. Use the scissors to cut out whole measures, then use the glue pot to paste them in somewhere else. Got a printer? Great. Print the score out and show it off to your friends.

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But what if you're not up to writing your own stuff yet? No problem. There are twelve pieces of music already in here, from rock 'n roll to baroque. They're fun to listen to, and even more fun to change. (Apologies to Mozart.)

The point is, the possibilities are endless. But if you're still skeptical, visit your nearest Electronic Arts dealer and do the one thing guaranteed to send you home with a Music Construction Set in tow.

Boot one up. Point to the piano. And listen.

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Stock	Close	Projected		% Growth	Comment
	Price	High	Low	possible	
Apple	39.25	54.47	20.40	38	Hold
Commodore	45.0	69.25	18.5	53	Hold
IBM	122.38	118.95	60.25	−3	Sell
Tandy	44.38	68.26	25.62	53	Hold
Warner Comm.	22.63	64.75	26.55	186	Buy
TI	117.63	116.67	76.41	41	Hold

Figure 1.

For our example, we will do a stock market program. This one of course will be a little different. There are plenty of programs around that will analyze the value of my portfolio. No, with delusions of adequacy bouncing through my skull, I want something that will predict stock prices for me.

I have observed that the long-term drift of some stocks is up over the years, while others seem to drift lower. If I could project what the high and low prices of a stock would be this year, I could make a bundle. It would be a simple matter of buying low and selling high. This seems like a worthy task for the computer so we will use it.

Table 1.

Variables Used In This Program

NS$(I)	Name of the Stock I
CP(I)	Closing Price
HP(I)	High Projected
LP(I)	Low Projected
GP(I)	Growth Possible
I	Index variable
NS	Number of Stocks in memory
NY(I)	Number of years of data on stock I
H(I,J)	High price of stock I in year J
L(I,J)	Low price of stock I in year J
LD(I)	Last dividend
H5(I)	52-week high price
L5(I)	52-week low price
J	General purpose counter
Y(I)	Yield
YP(I)	Yield Possible
G(I)	Growth
D	Dummy line fit variable
HS	Sum of Highs
HX	Sum of Highs times years
LS	Sum of Lows
LX	Sum of Lows times years
SX	Sum of years
S2	Sum of years square
A1	Various Sort holding variables
A2	
A3	
A4	
AD	
AE	
S$	
K	Sort counter
L	Sort counter
DS	Stock to Delete
N	Number available for stocks
A$	Answer string
X$	Output format string
YR	This year
DA	Date, used only for printout

A brief note is in order here before we go on. The example program here is fully functional. But not even the now famous Cretins From Mars would dream of using it as their primary investment tool. The basic procedure has done very nicely for me, *but,* I also do a great deal of research into the companies before I buy the stock. Anyone who does less . . . well there is an old saying about those people and their money.

Give your variables names that are meaningful.

Now we have decided on what we are going to do and have completed step one. Note that the idea isn't magnificent; I am sure we could accomplish the basic task on a pocket calculator. But this basic idea will change and expand before we are done.

Step Two

Design the output. Name the variables that will be printed out. Take two sheets of paper. One will be a rough sketch of the output screen. Put labels across the top and the side. Throw in a few numbers. Give some consideration at this point to how you will deal with the limitations of your screen display. Can you get all the information in 40 columns? Will you need more than one screen to display everything you want? Figure 1 is the preliminary design for my screen display.

My variable list is shown in Table 1. This list is the beginning of our documentation. You can see how much easier it will be to do this now than waiting until later. The other choice is to try to figure everything out after finishing the program. If you try this several weeks later it will be a pain. We will add to our initial list of variables as we go along.

Doing it this way eliminates the possibility of using the same variable name for two different things at different places in the program. That can be a particularly difficult bug to track down. And, for example, we will use this list in creating our PRINT statements. The Basic output statement will be

```
PRINT NS$(I);CP(I);HP(I);
  LP(I);GP(I)
```

It bears some repeating. Give your variables names that are meaningful. Sure. You could use A$ for Stock Name but what is the point? You can't really hide a Basic program very well. You can just make it harder on yourself and others who have to work on your program. So use SN$. Use STOCKNAME if your machine will support a variable name that long.

Step Three

Write a list of inputs needed to create those outputs. Name those variables and add them to the list. For this task I will need the high and low prices for each stock for several years. I get these from the Stock Guides published by Standard and Poors. I will also need the closing prices, which I will get from the *Wall Street Journal.* I will take the last dividend paid and the 52-week high and low prices. Obviously I will need the names of the stocks, but I can make those up. These variables will form the heart of our INPUT statements. So we extend our variable list with the following:

NY(I)- Number of Years of data on stock I
H(I,J)- High price of stock I in year J
L(I,J) - Low price of stock I in year J
LD(I)- Last Dividend
H5(I) - 52-week high price
L5(I) - 52-week low price
J - General purpose counter

Step Four

Decide what formulas or procedures you will need. The formulas will be the guts of the program. Most of the rest could be considered utilities to keep everything neat and clean. Some programs don't use formulas in the classic sense. They deal with procedures and you need to work out what those procedures will be.

Two of my formulas are straightforward. I am now calculating yield using

```
Y(I)=LD(I)/CP(I)*100
```

and the possible growth as

```
GP(I)=(HP(I)/CP(I)-1)*100.
```

The equation for the curve fitting routine was taken from a book of

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First Program, continued...

mathematical tables. I have already done the algebraic manipulations to put those in a form that the program can use. My experience is that many things work faster and are easier to program if you solve some of the preliminaries first.

You will run into this sort of problem only in cases that require algebra. There are plenty of tasks and programs that don't require anything this exotic. But if you choose a task that requires it, you will have to be able to work it out yourself. Or you will have to find someone who can.

The formulas that appear in this program are a Least Means Square fit for a straight line to minimize the amount that the points are off. I have solved the equations for a special case. The general equation for a line is:

```
Y = M * X + C
```

Since I am interested only in a single year's worth of data, I decided to call this year 0. That means that I need to solve only for C since the value of M will be negated by the X value of zero.

Step Five

Write, in English, a simplified procedure for what you want to do. Number the steps. Now, finally, we are ready to start thinking about the program. Slap these steps down quickly so we will have a form for the entire project before we start to work out the details. An important note here: always put initialization first.

My rough list for this program is:

0. Initialization
1. Get the data on the stocks
2. Make the calculations
3. Display the results

For some programmers this is the point at which they start thinking about drawing a simple flow chart. Everyone should learn to use flow charts if only to find out what they can do. That is a subject for another article. I never use them.

Step Six

Think some more about the project. Add steps to the procedure list to cover anything you can dream up. Imagine as many different possibilities as you can. Hmmm. We might want to look at the same stocks more than once, and it would be quite a hassle to re-enter all that information all the time. Besides, I have a disk drive to use for this sort of thing. So I write:

4. Save stock data on disk

And, of course, that doesn't make much sense without:

5. Get stock data from disk

I also have a printer so I will

6. Print the output as an option

It is also possible, though unlikely, that I will make a mistake in entering the data, so I had better have the program:

7. Check for Input Errors

Speaking of errors, what if the program projects a high that is lower than the low? Or a low that is lower than zero? I guess we should:

8. Check projected highs and lows for errors

9. Check for disk errors

It would be nice if I could see the list of names in alphabetical order. So let's

11. Sort the stocks

and the computer memory isn't unlimited. There may come the time when I will have to

12. Delete a stock

I suppose it is obvious how some relatively simple tasks become major programs. The heart of the program is step 2. We had to have steps 0, 1 and 3. Now we have 12 steps. We could keep this up forever. To some extent, the longer you consider the project before you actually start programming, the better off you will be. Eventually, though, you will have to move on to the next step.

Step Seven

Rearrange the list in the correct order. Or write a "mainline section" that calls the list in the correct order. Adding the mainline section is more in keeping with the structured programming approach. It does offer some significant flexibility features and eventually you will want to consider using it. Using that technique, our list becomes something like this:

```
 0. Initialization and goto mainline
 1. Get the data on the stocks
    a. Check for input errors
    b. If too many, GOSUB delete a
       stock
    c. GOSUB sort the stocks
 2. Make the calculations
    a. Check for high/low errors
 3. Display the results
 4. Save stock data on disk
    a. GOSUB check for disk errors
 5. Get stock data from disk
    a. GOSUB check for disk errors
 6. Print the output as an option
 7. Check for input errors
 8. Check projected highs and lows
    for errors
 9. Check for disk errors
10. Sort the stocks
11. Delete a stock
12. Mainline
    a. GOSUB get the data from disk
    b. GOSUB get the data on the
       stocks
    c. GOSUB make the calculations
    d. GOSUB display the results
    e. At user option GOSUB print
       the results
    f. GOSUB save the data to disk
```

Dave Powell

"Well, nurse, I'm afraid this one is a terminal case."

I use the fully structured approach only when I attack a major project.

We recognize that many of these subroutines will be called by the other subroutines rather than from the mainline so we entered them as subroutines from the main points of the program.

I prefer to rearrange the list into a single sequence. I use the fully structured approach only when I attack a major project. It should be noted that even my approach will end up with major subroutine jumps as we expand and modify what the program does. My list looks like this:

```
0. Initialize
1. Get the data from the disk
   a. Check for disk errors
2. Get the data on the new stocks
   a. Check for input errors
   b. If too many then delete a stock
   c. When done sort the stocks
3. Make the calculations
   a. Check for high/low errors
4. Display the results
5. At the user's option print the
   results
6. Save the data on disk
   a. Check for disk errors
```

This structure will be the basic form of our program.

Step Eight

Take each section of the procedure and write the individual sub-steps for doing that section. This step is a long one. In some special cases you will be able to skip portions of this detailed description. If, for example, you have an acceptable sort routine, use it. There is no point in reinventing the wheel. Just be careful to modify all the variables correctly.

I use an "index card" sort that I find to be much faster than a Bubble sort (but then almost everything is) and almost as stingy with memory. The index card sort works best for a relatively few records that are almost in order. If you plan to sort a large number of records, you will want to use one of the other sorts.

A few examples should illustrate the idea here. As you get more proficient you will find yourself writing these steps in computer language instead of English. For your first couple of programs, though, everything will be easier if you write these steps in English. We will do the translation in a later step. See Figure 2.

Figure 2.

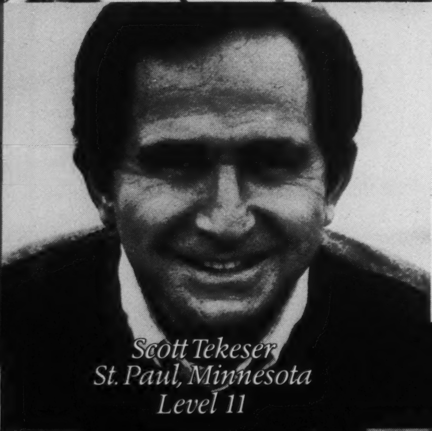
```
0. Initialize.
   a. Clear the screen
   b. Clear enough string space for
      the names
   c. Zero all the variables
   d. Print a title page so I will know
      what it is
   e. Dimension the arrays
   f. Set the error trap
2. b. Delete a Stock
      1. Ask which stock to delete
      2. Make sure it is a legal stock
         a. If not then ask again
      3. Reduce number of stocks by
         one
      4. For all the stocks from there
         to top
      5. Move stock data up by one
3. Make the calculations
   a. Solve the line fit
   b. Check for high/low errors
      1. if low price is less than zero
         set it to zero
      2. if high price is greater than
         the low set the high to the
         average and the low to the
         average minus one
   c. Calculate yield and growth for
      each stock
6. Save data on disk
   a. Open the disk file—
      STOCKS/DAT
   b. For each stock write to the disk
      file
      (1) Name of Stock, last
          dividend, 52-week high, 52-
          week low. Number of years
          of high/low data
      (2) For each year save high/low
          prices
   c. Close the disk file
```

Larry Barbato
Springfield, Virginia
Level 13

Cindy Horne
Portland, Oregon
Level 12

Doug Hockstad
Escanaba, Michigan
Level 13

Mark E. Renne
Bozeman, Montana
Level 15



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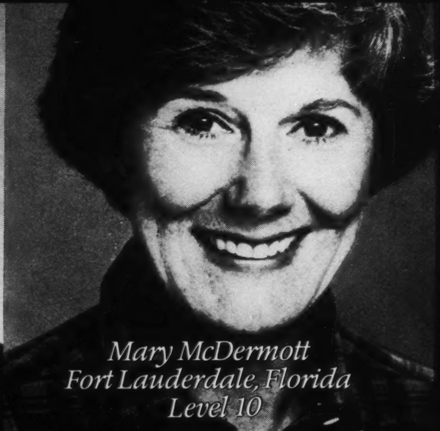
St. Paul, Minnesota
Level 11

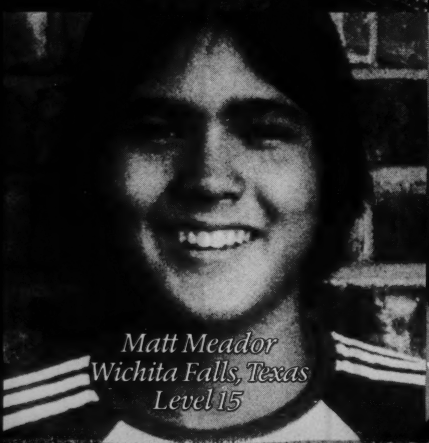
David Silver
New York, New York
Level 10

Stanley LaGarde
Springfield, Massachusetts
Level 11

Karl Mikesell
Palatine, Illinois
Level 20



Mary McDermott
Fort Lauderdale, Florida
Level 10



Matt Meador
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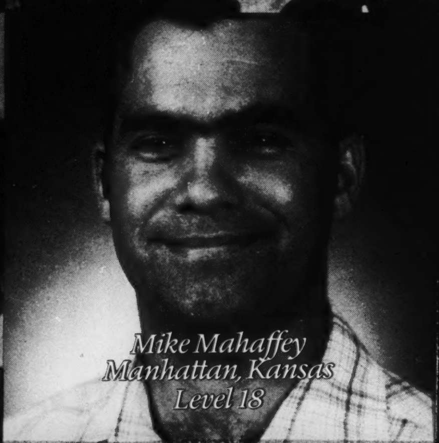
Jean Cole
San Diego, California
Level 14



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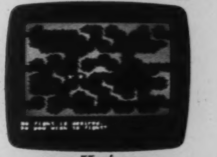
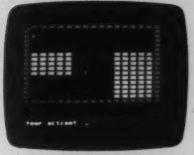
Dunzhin



Kaiv

Wylde



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After you have done this for every routine from your earlier list and all the ones that have occurred to you as you were writing this out, read through the logic. Do you have everything? Have you made any assumptions? While you are at it, double check your variable list to make sure it is complete. There will be only a few additions after this step.

Step Nine

Go to the computer. Give each step in your procedure a line number in increments of 100. Use larger steps for those sections that you think will be longer. Write a remark as the step instruction. See Figure 3.

Figure 3.

```
 001 Rem Stock market program
 002 Rem Initialize
 100 Rem Get the data from the disk
 190 Rem Check for disk errors
 200 Rem Get the data on the new
      stocks
 400 Rem If too many then delete a
      stock
 500 Rem Check for input errors
 600 Rem When done sort the stocks
 700 Rem Make the calculations
 830 Rem Check for high/low errors
 900 Rem Display the results
1000 Rem At the user's option print
      the results
1100 Rem Save the data on disk
1200 Rem Check for disk errors
```

Some of the lines will end up being pushed back. Some of the sections will require more room than we originally anticipated. Others will require less room. You will note from the example program that deleting a stock took much more room than I had originally anticipated. And I chose to delete the extra stock before I got the data on the new one. These remarks will form a major portion of our internal program documentation.

Step Ten

Translate your written instructions into the program steps. This is what the exercises in the programming manual were all about. Note how far you have come without getting involved with a programming language. This does not mean that the programming language is unimportant; you won't get beyond this point unless you know it well. The point is that there is a great deal of work to do before starting to write programming code. The initialization section in Microsoft Basic for the TRS-80 is shown in Figure 4.

There is a great deal of work to do before starting to write programming code.

Figure 4.

```
001 REM INITIALIZATION
002 CLS
003 PRINT "STOCKS PROGRAM"
004 CLEAR 1000
005 N=30
010 DIM NS$(N),LD(N),H5(N),
     L5(N), HP(N) . . .
020 ON ERROR GOTO 1200
```

If you have done the earlier steps correctly, this should be an almost line-for-line conversion. As a general note here, we recognize that we will be adding more lines and modifying them. Normally we number our lines by 10 to make inserting lines easier.

Step Ten

Test the program. Debug and rewrite as necessary. Add in user prompts where helpful and add error trapping routines.

This is the most important step. Try as we may to think things out in advance, there will always be problems that we failed to anticipate. Make sure your testing sends the program through each possible statement. Try some of these:

- Simply press ENTER in response to all questions.
- Enter negative numbers.
- Enter silly numbers.

Did the absurd numbers cause the program to blow up? What does it do when you enter a negative price? Your program should be able to handle, or refuse to handle, all of these cases. Although I haven't done so in this program, it is normally a good idea to give the user the option of correcting the input data. Test and retest. Never assume that a computer program is correct until you have proven that it is correct.

This is the time for correcting display problems. I have noted that my computer memory can handle more stocks than I can display at once. Unless I put in some sort of *paging* routine, some of the information will go flying off the top of the screen before I can read it. That is not normally considered good programming practice.

Are there long periods when the user is staring at a blank screen? You don't want him to think that the computer has died a silent death. Sort routines frequently give the impression of a locked up computer sitting there using electricity.

There are a couple of ways of handling this problem. One is to put up a large disply for the user to read while the computer is working. If the user is busy, he will never notice that nothing apparent is happening. Another approach is to give periodic updates. Show the user what is happening. I have done this by showing the stocks as they are read.

Pretend that you are a complete idiot. Could you figure out how to use the program with the prompts shown? Does your program need a built-in page of instructions? Why not have the user read the instructions while the computer reads in its data?

Step Eleven

Optional clean up steps:

- Rewrite to streamline.
- Rewrite for speed.
- Renumber.
- Add internal instructions.

If you are like most programmers you will find yourself reworking programs until the day you stop using them. These optional steps are only a few of the possible changes. They are strictly optional. We now have a tested, working program and enough documentation to make the revisions feasible. The finished program appears in Listing 1. END

"Sorry, miss, but this seems to be my portable computer."

First Program, continued...

Listing 1.

```
1 REM STOCK MARKET PROGRAM BY STEPHEN KIMMEL
2 CLS:REM INITIALIZE
10 PRINT@467,"STOCK MARKET PROGRAM"
20 PRINT@539,"BY"
30 PRINT@597,"STEPHEN KIMMEL"
40 REM THIS STATEMENT IS PACKED BECAUSE IT IS A SINGLE THOUGHT
50 FOR I=1TO10:PRINT@RND(959),CHR$(36);:PRINT@RND(959),CHR$(91);:PRINT@RND(959),CHR$(92);:NEXT
60 CLEAR 1000
70 N=30:I=0:YR=1982
80 ONERROR GOTO1200
90 DIM NS$(N),LD(N),H5(N),L5(N),HP(N),LP(N),H(N,5),L(N,5),Y(N),G(N),CP(N),YP(N),GP(N),NY(N)
100 REM GET DATA FROM THE DISK
105 OPEN "I",1,"STOCKS/DAT"
110 INPUT#1,NS
115 FOR I=1TONS
120 INPUT#1,NS$(I),LD(I),H5(I),L5(I),NY(I),HP(I),LP(I)
125 CLS:PRINT"READING DATA ON ";NS$(I)
130 FOR J=1 TO NY(I)
135 INPUT#1,H(I,J),L(I,J)
140 NEXTJ
145 NEXT I
150 CLS:PRINT"I HAVE DATA ON THE FOLLOWING STOCKS"
155 FOR I=1TO NS
160 IF INT(I/13)=I/13 THEN GOSUB 1410:PRINT@64,CHR$(31);
165 PRINTNS$(I)
170 NEXT
175 CLOSE
200 REM GET DATA ON THE NEW STOCKS
205 INPUT"ENTER NEW STOCKS";A$
210 IF A$="NO" OR A$="N" THEN 700
215 IF A$<>"YES" AND A$<>"Y" THEN 205
225 IF NS<N THEN 420
230 REM IF TOO MANY THEN DELETE A STOCK
240 CLS:PRINT"WE ALREADY HAVE THE MAXIMUM NUMBER OF STOCKS. WE'LL NEED TO  DELETE ONE."
250 PRINT "I HAVE THE FOLLOWING STOCKS:"
260 FOR I=1TON:PRINTI;NS$(I),:NEXT
270 PRINT@896,"ENTER THE NUMBER FOR THE STOCK YOU WANT TO DELETE."
280 INPUT"WHICH STOCK";DS
290 IF DS<1 OR DS>N THEN 240
300 NS=NS-1
310 FOR I=DS TO NS
320 HP(I)=HP(I+1)
330 LP(I)=LP(I+1)
340 NS$(I)=NS$(I+1)
350 H5(I)=H5(I+1):L5(I)=L5(I+1):CP(I)=CP(I+1):LD(I)=LD(I+1)
360 NY(I)=NY(I+1)
370 FOR J=1TONY(I)
380 H(I,J)=H(I+1,J):L(I,J)=L(I+1,J)
390 NEXTJ
400 NEXTI
420 I=NS+1
425 CLS
430 INPUT"WHAT IS THIS STOCK'S NAME";NS$(I)
435 IF NS$(I)="" THEN GOTO 525
440 INPUT"WHAT WAS THEIR LAST DIVIDEND";LD(I)
445 INPUT"IT'S 52 WEEK HIGH";H5(I)
450 INPUT"IT'S 52 WEEK LOW ";L5(I)
455 REM CHECK FOR INPUT ERRORS
460 IF H5(I)<=0 THEN 445
465 IF L5(I)<=0 THEN 450
470 IF L5(I)>H5(I) THEN 445
475 INPUT"HOW MANY YEARS OF DATA";NY(I)
480 IF NY(I)>5 THEN PRINT"5 YEARS IS THE MAXIMUM.":NY(I)=5
485 IF NY(I)=0 THEN 520
490 FOR J=1TONY(I)
495 PRINT "HIGH FOR ";YR-J;:INPUT H(I,J)
500 PRINT "LOW FOR ";YR-J;:INPUT L(I,J)
505 REM CHECK FOR INPUT ERRORS
510 IF L(I,J)>H(I,J) THEN 495
515 NEXT
520 NS=I
525 INPUT"DO YOU WANT TO ENTER MORE STOCKS";A$
530 IF A$="YES" OR A$="Y" THEN 220
535 IF A$<>"NO" AND A$<>"N" THEN 525
600 REM WHEN DONE SORT THE STOCKS
605 CLS:PRINT"PARDON ME WHILE I SORT THIS OUT."
610 FOR J=1 TO NS:PRINT@64,J/NS;"% DONE  "
615 FOR I=J TO NS
620 IF NS$(J)<=NS$(I) THEN 670
625 A1=H5(I):A2=L5(I):A3=LD(I):A4=NY(I):S$=NS$(I)
630 FOR K=1TO NY(I):AD(K)=H(I,K):AE(K)=L(I,K):NEXT
635 FOR L=I TO J+1 STEP -1
640 NS$(L)=NS$(L-1):L5(L)=L5(L-1):NY(L)=NY(L-1)
645 H5(L)=H5(L-1):LD(L)=LD(L-1)
650 FOR K=1 TO NY(L-1):H(L,K)=H(L-1,K):L(L,K)=L
   (L-1,K):NEXTK
655 NEXT L
660 NS$(J)=S$:H5(J)=A1:L5(J)=A2:LD(J)=A3:NY(J)=A4
665 FOR K=1TONY(J):H(J,K)=AD(K):L(J,K)=AE(K):NEXTK
670 NEXTI
675 NEXT J
700 REM MAKE THE CALCULATIONS
705 FOR I=1TONS:IF NS$(I)="" THEN 910
710 CLS
715 PRINT"WHAT WAS THE CLOSING PRICE FOR ";NS$(I);
720 INPUT CP(I)
725 IF CP(I)<=0 THEN 715
730 IF CP(I)>H5(I) THEN H5(I)=CP(I)
735 IF CP(I)<L5(I) THEN L5(I)=CP(I)
740 REM CALCULATE PROJECTED HIGH AND LOW
745 IF NY(I)=0 THEN HP(I)=H5(I):LP(I)=L5(I):GOTO830
750 IF NY(I)>1 THEN 770
755 HP(I)=2*H5(I)-H(I,1):LP(I)=2*L5(I)-L(I,1):GOTO830
760 REM LEAST SQUARES LINE FIT
765 REM THIS IS A SINGLE THOUGHT TOO
770 SX=0:S2=0:HS=0:LS=0:HX=0:LX=0
775 FOR J=1TONY(I)
780 SX=SX+J
```

First Program, continued...

```
785 S2=S2+J*J
790 HS=HS+H(I,J)
795 LS=LS+L(I,J)
800 HX=HX+H(I,J)*J
805 LX=LX+L(I,J)*J
810 NEXTJ
815 D=(NY(I)+1)/SX-SX/S2
820 HP(I)=((H5(I)+HS)/SX-HX/S2)/D
825 LP(I)=((LS+L5(I))/SX-LX/S2)/D
830 REM CHECK HIGH/LOW ERRORS
835 IF LP(I)<0 THEN LP(I)=.125
840 IF HP(I)<0 THEN HP(I)=1
845 IF HP(I)>LP(I) THEN 855
850 HP(I)=(LP(I)+HP(I))/2:LP(I)=HP(I)-.25
855 PRINT"PROJECTED HIGH IS";HP(I)
860 PRINT"PROJECTED LOW IS ";LP(I)
865 Y(I)=INT(10000*LD(I)/CP(I))/100
870 G(I)=INT(100*(HP(I)/CP(I)-1))
875 GP(I)=INT(100*(HP(I)/LP(I)-1))
880 YP(I)=INT(10000*LD(I)/LP(I))/100
885 GOSUB 1410
890 NEXT
900 REM DISPLAY THE RESULTS
910 CLS:PRINT"STOCKS            YIELD          GROWTH          PROJECTED"
920 X$="%           %###.##  ###.## #### #### ###.## ###.## ###.##"
930 FOR I=1TONS
940 IF INT(I/13)=I/13 THEN GOSUB 1410:PRINT@64,CHR$(31);
950 PRINTUSING X$;NS$(I),Y(I),YP(I),G(I),GP(I),HP(I),LP(I);
960 IF CP(I)>.9*HP(I) THEN PRINT" SELL?":GOTO 990
970 IF CP(I)<1.1*LP(I) THEN PRINT" BUY?":GOTO 990
980 PRINT" "
990 NEXT
1000 REM AT USER OPTION PRINT THE RESULTS
1005 INPUT"DO YOU WANT A PRINT OUT";A$
1010 IF A$="YES" OR A$="Y" THEN 1025
1015 IF A$<>"NO"AND A$<>"N" THEN 1005
1020 GOTO 1105
1025 PRINT@832,"PLEASE BE SURE THE PRINTER IS ON"
1030 GOSUB 1410
1032 INPUT"WHAT IS THE DATE";DA$
1035 X$="%           %###.##  ###.##  ###.##  #### #### ###.## ###.## ###.##"
1040 LPRINT "STOCK MARKET REPORT ON ";DA$
1045 LPRINT"STOCKS          CLOSE      YIELD        GROWTH     PROJECTED"
1050 LPRINT"                PRICE     %      MAX    CUR  MAX   HIGH   LOW"
1055 FOR I=1TONS
1060 LPRINTUSING X$;NS$(I),CP(I),Y(I),YP(I),G(I),GP(I),HP(I),LP(I);
1065 IF CP(I)>.9*HP(I) THEN LPRINT" SELL?":GOTO 1080
1070 IF CP(I)<1.1*LP(I) THEN LPRINT" BUY?":GOTO 1080
1075 LPRINT" "
1080 NEXT
1100 REM SAVE DATA TO DISK
1105 PRINT@832,"PLEASE BE SURE TO HAVE A DISK IN THE DISK DRIVE":GOSUB 1410
1110 OPEN "O",1,"STOCKS/DAT"
1115 PRINT#1,NS;",";
1120 FOR I=1TO NS:PRINT#1,NS$(I);",";LD(I);",";H5(I);",";L5(I);",";NY(I);",";HP(I);",";LP(I);",";
1125 FOR J=1 TO NY(I)
1130 PRINT#1,H(I,J);",";L(I,J);",";
1135 NEXTJ
1140 NEXT I
1145 CLOSE
1150 END
1200 REM ERROR TRAP
1210 CLOSE
1220 IF ERL=1110 THEN RESUME 1105:REM DATA OUTPUT ERROR
1230 IF ERL<>105 THEN PRINT"UNEXPECTED ERROR IN LINE ";ERL:END
1240 PRINT@0,"";:INPUT "IS THIS YOUR FIRST TIME THROUGH THIS PROGRAM";A$
1250 IF A$="YES" OR A$="A" THEN 1290
1260 IF A$<>"NO" AND A$<>"N" THEN 1240
1270 PRINT"PLEASE BE SURE YOU HAVE YOUR STOCK DATA DISK IN THE DRIVE.":GOSUB 1410:RESUME 105
1280 CLOSE
1290 REM INSTRUCTIONS
1300 CLS:PRINT"THIS PROGRAM PROJECTS A STOCK'S HIGH AND LOW PRICES FOR THE YEAR BASED ON ITS HIGH AND LOW PRICES
     FOR THE  LAST SEVERAL YEARS. IT ALSO CALCULATES THE YIELD PERCENT AND PROJECTED CAPITAL GROWTH  THAT A
     STOCK WILL YIELD."
1310 PRINT"THE REQUIRED INPUTS ARE:
        THE STOCK'S NAME (SUCH AS TANDY)
        LAST YEAR'S DIVIDEND
        THE 52 WEEK HIGH PRICE
        THE 52 WEEK LOW PRICE
        THE HIGH AND LOW PRICES FOR THE LAST COUPLE OF YEARS
        THE CLOSING PRICE."
1320 PRINT:PRINT"THIS INFORMATION IS AVAILABLE IN THE WALL STREET JOURNAL AND IN THE PUBLICATIONS OF STANDARD
     AND POORS."
1330 NS=0
1340 GOSUB 1410:CLS
1350 RESUME 205
1400 REM PAGING ROUTINE
1410 PRINT@896,"PRESS <ENTER> TO CONTINUE";:LINEINPUT A$:RETURN
```

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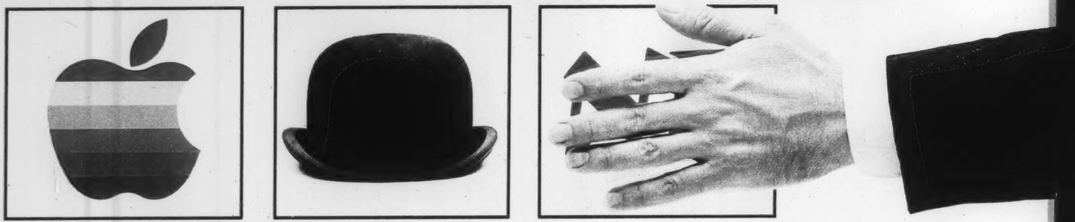

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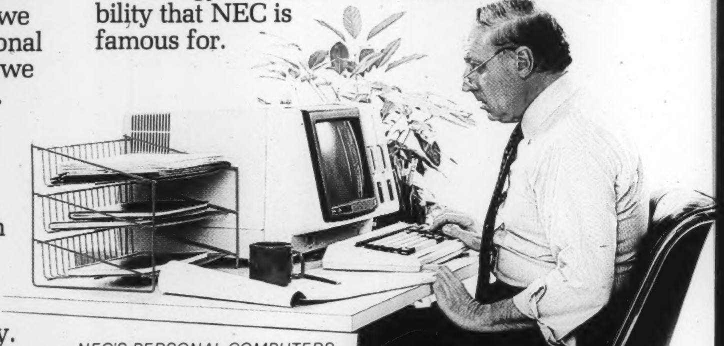

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Basic Debugging

A Structured Approach

Reginald Gates

All of us want to write error-free programs, but since we are human, we all need to learn debugging skills. What follows is a structured approach to locating and correcting program problems. Given the nature of programs and programmers, this cannot be an exhaustive treatment of the subject, but it will give us a place to start. We will begin by looking at the debugging tools we can use, then at the analysis of the error itself, and finally at the types of bugs we are likely to encounter.

What Help Do We Have?

The first question we should answer is: What resources are available from the system to help us? Every compiler or interpreter comes with certain features designed to make debugging easier. Below are some of the debugging aids available in most Basics. Although the implementation of the feature may vary with the version of Basic you are using, the function still should be present.

Break

The BREAK function is tied to key input. The Basic interpreter monitors the keyboard during execution, and, if the key corresponding to the BREAK function is depressed, the interpreter will halt execution and tell us what the line number is being executed. (Break in line 2055 is a typical message.)

This function is implemented by CONTROL-C in some Basics. We should also be aware that some systems permit the program being executed to disable this feature.

The most important thing about BREAK is that when it is invoked, control returns to the user, but the values of the program variables are left as they were when the BREAK was executed. This enables us to use the next feature extensively.

Print Command

Most Basics permit a PRINT statement to be entered as a command, i.e., to be entered whenever the Basic interpreter is waiting for a statement from the user. The operands for the PRINT command can be any of the variables for the program being tested.

This enables us to examine the contents of both string and numeric variables after the Break feature has been used.

Stop

If a STOP statement is placed in the program, Basic will cease execution when it encounters that statement and return control to the user. The user can then use PRINT to examine the variables, much as was done after the BREAK feature.

Most Basics allow TRACE to be used as both a command and a statement.

Since STOP is a statement, it can usually be coded in an IF test. For example, if the program seems to be having trouble in a certain routine whenever X is negative, we could code.

```
1022 IF X < 0 THEN STOP
```

Continue

This command permits us to resume execution after a STOP statement or BREAK command. When combined with the STOP and PRINT features. CONTINUE is a very useful debugging tool. For example, we can halt a loop on every iteration, examine the variables, and then continue execution. See Listing 1 for an example.

When the STOP in statement 125 is executed, we can Print D, X, and Y to see if routine 2000 was successful. If so, we can say CONTINUE to go to the next value of D. In this manner we can step through the loop, looking for a D that produces an invalid X and Y.

Trace

When this feature is invoked, Basic displays the line number of each program statement as it is executed. In this manner, we can tell exactly which program statements are being used and in what sequence.

Use of the TRACE feature does have a few drawbacks. For one thing, the TRACE line numbers are interspersed with material displayed by the program on the screen. The resulting display can be very confusing. Also, the volume of output is high, so the screen scrolls fairly rapidly and we may miss important information.

Most Basics allow TRACE to be used as both a command and a statement, so that TRACE ON can be placed within the body of a program or coded in an IF statement.

Freeze

At least one Basic is set up so that the depression of CONTROL-A freezes the display. When the key is released, execution resumes. This permits us to look at a screen, note any important data, and then continue.

Now that we know what resources we have, we are ready to turn to the most important step in debugging—defining the problem.

What Is The Problem?

The problem with the program must be defined as thoroughly as possible. A good definition answers at least three questions:

- What does the program do?
- When does it do it?
- What should it have done?

Generating this definition is a suprisingly difficult task and many people are tempted to bypass this step and start to look at the code.

If we cannot describe the problem in a

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```
100 For I=1 TO 100
105   READ D
110   GOSUB 2000 : REM CALC COORDINATES X,Y
120   GOSUB 3000 : REM CALC SLOPE AND SUM
125   STOP
130   NEXT I
```

Listing 1.

short, written paragraph that includes the three elements above, we must continue our analysis. For one thing, if we don't know precisely what the problem is, how will we know when (or if) it is corrected? How will we know which area of code to look at? And how can we generate an appropriate set of test data if we can't describe what we are to test? An exact problem definition is a pre-requisite to any debugging.

Below are three versions of a bug definition recently corrected in an on-line order system that I was working on. Once the third statement had been developed, the correction was relatively easy.

Defining the problem thoroughly can even suggest a new approach or a novel solution.

- The lousy pricing routine doesn't work.
- The pricing routine doesn't handle some future-dated contracts right.
- When a customer has multiple contracts, the pricing routine uses the first contract it encounters in the file, even though that contract takes effect in the future. The routine should use the first contact whose beginning date is less than or equal to today's date.

Defining the problem thoroughly can even suggest a new approach or a novel solution. When I first started in programming, our group had a problem with a daily program that tracked drawings from station to station in a large aerospace company.

Whenever there was a tape drive failure while this job was active, it would release all the drawings we had. Rerunning the job always corrected the situation, but no one could figure out how the tape drive problem could cause the program failure.

We corrected this bug by adding a special counting routine to the program. If this routine detected that all the drawings input had been released, it produced a message to the operator instructing him to re-run the job when all the tape drives were operational. Some purists may object that this was not a real solution, but it did eliminate many late night phone calls.

Once the problem has been defined, it is very helpful to have an idea of what we are looking for before we start to study the code. Accordingly we will now look at the ways in which errors can be classified.

What Kind Of Error?

The coding within the program can be thought of as a series of interrelated structures or units, each of which follows this general pattern:

Listing 2.

```
10 INPUT A
20 FOR I=1 TO A
30 PRINT I,A*A
40 B=B+A*A
50 NEXT I
60 PRINT B
```

1. Sequential processing
2. Conditional or loop control
3. Repetitive processing for 2 above.

For example, in the short program in Listing 2, statements 10 and 60 are sequential processing/initialization, statement 20 controls a loop, and 30 and 40 belong to class 3 above.

We can classify program bugs according to this same general scheme. This will help us in determining where (in what type of coding structure) to look for the error.

1. *Sequential Processing/Initialization Errors.* In this type of error variables are not set properly, usually prior to executing a set of repetitive processing statements. The results of the repetitive processing are off by a fixed amount, or major branches in the logic are not taken. For example, the code in Listing 3 seems to contain a simple programming error in statement 500.

Apparently there is some special processing to be done when the first negative value of the A array is encountered. However, because W1 is set to 1 in statement 500, the routine at 2000 is never executed. The TRACE feature will easily show us that the 2000 routine is never invoked, or we may place a STOP as the first statement in the 2000 routine. Since the routine will never be entered, the STOP statement will never be encountered, and we may deduce that there was no negative A(I) or that W1 was not set correctly.

2. *Repetitive Errors.* Errors of this type are characterized by the resulting data being wrong "in the same way" for a set of input. For example, suppose the following code was used round dollar amounts in an array.

```
100 FOR I = 1 TO N1
110 A(I) = INT(A(I)+.05)
120 NEXT I
```

Since all entries in the array that have a cent amount of less than 95 cents will not be rounded properly, we will expect that some statement in the repetitive processing is incorrect.

3. *Loop Control or Conditional Errors.* These can be simple coding logic errors or some of the most difficult errors to debug. One of the most simple and yet most common conditional errors is shown below. It involves mixing an OR test with a not equal conditional.

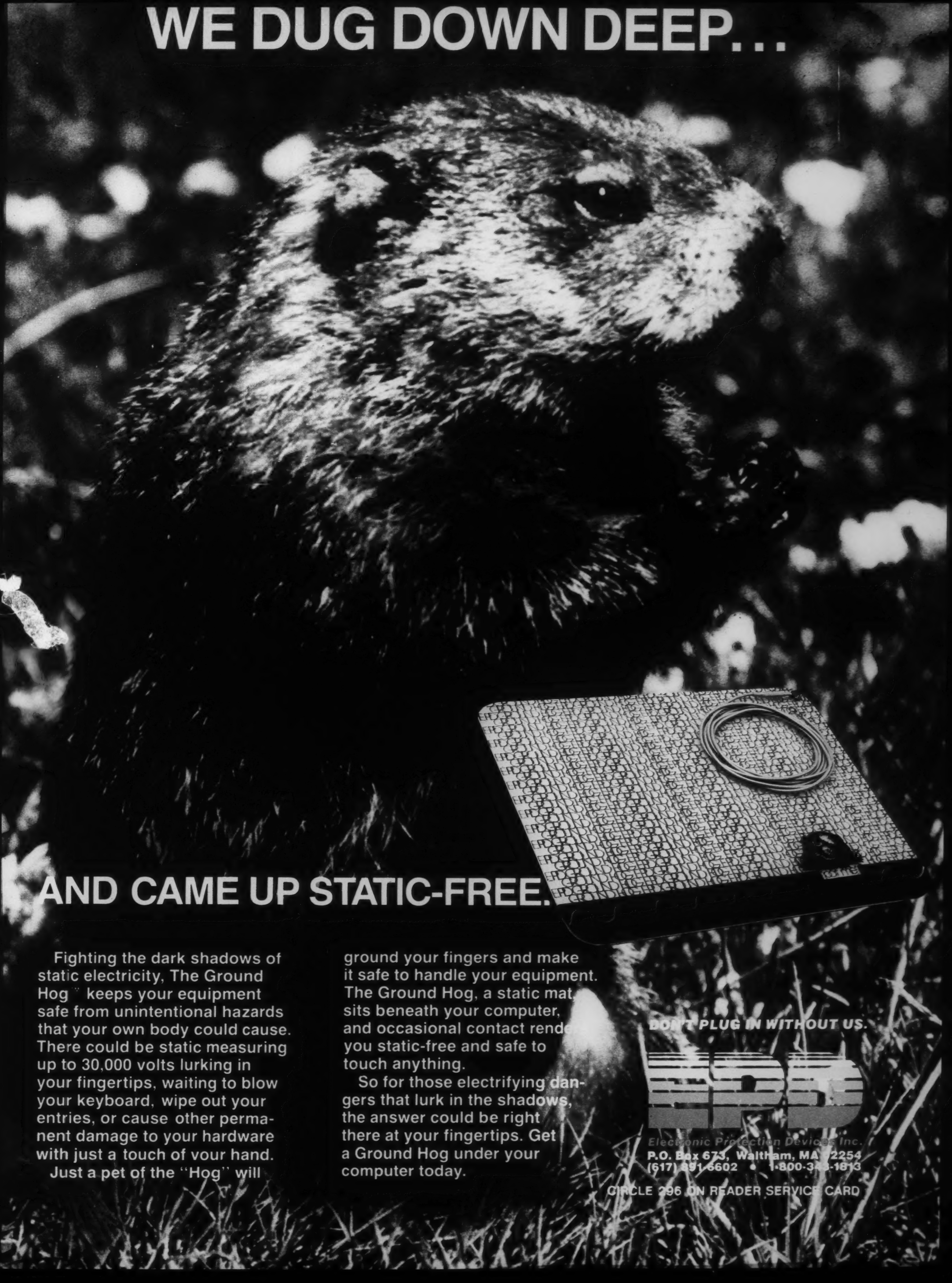
```
1000 IF A < > 1 OR A < > 2 THEN
GOSUB 2000
```

Routine 2000 will always be executed, regardless of the value of A. If A is 1, it is not equal to 2, so the GOSUB is executed. IF A is 2, it is not equal to 1, and the GOSUB is executed. Again, the TRACE feature will show us this type of problem, or we might put a STOP statement at the beginning of the 2000 routine. When the program halted, we could then print the value of A and observe that we were entering the subroutine when we shouldn't be (when A is 1 or 2).

A more difficult problem occurs when control is lost in a FOR-NEXT loop. Usually an infinite loop results and the pro-

Listing 3.

```
500 T=0 : F1=1 : W1=1
510 FOR I=1 TO 100
520   IF A(I)< 0 AND W1=0 THEN GOSUB 2000
 •
 •
 •
2000 W1=1
 •
 •
 •
```



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gram repeats the same set of instructions over and over. This results in no response or output to the screen for a long time or in the same response being displayed over and over again.

Using the BREAK feature will stop the program in one of the instructions (not necessarily the FOR or the NEXT instruction). We may then print the variables involved in the nearby statements and try to determine why we are not exiting the loop. Usually we will find that one variable is controlling the repetition and that this variable is modified incorrectly by one of the statements or subroutines in the loop. The code in Listing 4 will produce an infinite loop of this type.

```
300 FOR I=1 TO C1
310   IF S1(I)=1 THEN GOSUB 3000 ELSE GOSUB 4000
320   GOSUB 5000
       •
       •
       •
380 NEXT I
5000 FOR I=1 TO 25
5010   IF MID$(N$,I,1)="," THEN J=1
5020   NEXT I
        •
        •
        •
5099 RETURN
```

Listing 4.

CHESS
HANSEN

"Let's see how well my little computer plays now that I've evened up the odds a bit."

If C1 is greater than 25, the exit condition in 300 will never be satisfied, since the subroutine at 5000 will leave I set at 25 when it exits, regardless of the value of I when the subroutine was entered. Of course, this is easy to see when only the relevant routines are listed. It is much harder to find when the 3000 and 4000 subroutines must also be examined.

The TRACE feature will show us what statements are executed, but it will not give us an idea of where I is being reset. The best approach might be to put a STOP statement after each statement that invokes a subroutine in the 300 area. We can then display I at each point and isolate the offending subroutine.

Although there is no universally useful procedure for debugging a program, as you can tell by the number of times we used "usually" or "normally" in the examples above, the type of structured approach that we have discussed can be very helpful.

Remember, know your tools, define the problem, classify the error, and good luck. END

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CIRCLE 247 ON READER SERVICE CARD

The CBasic Clinic

Part Two

John A. Libertine

In our first session, we learned that CBasic is probably the most advanced of the Basic family of computer languages. It lends itself to structured, modular programming, and has powerful file handling features. Many of its mathematical functions and variable formats are unique for a Basic and approach the methods used in Pascal and Ada.

Most important, we learned that CBasic is a compiled language. It is written on a text processor and put through a compiler to write an intermediate file which is used to run the program. We then wrote and ran a simple program to illustrate the procedure. Now we begin to dig into the details which will eventually make it possible for you to use CBasic on a practical level.

We have already had some exposure to the use of variable names. You now know a variable can have up to 31 *significant* characters. This allows self-explanatory names (End.of.month.total, for example) which can be a great aid to self-documentation and/or debugging. Also, you can use different variables with the very same first several characters (Total.1 and Total.2, or Name.and.address.sales$ and Name.and.address.purchasing$). The periods between words make for easier reading. They are not necessary, but who wants to decipher Nameandaddresspurchasing$?

Note that the variables above are all typed in upper- and lowercase. Here's another small advantage of CBasic. Variables can be written in all caps, upper and lower or all lowercase. Even key words like PRINT and GOTO can be any case you want. The compiler automatically converts them to uppercase for you.

Integers occupy much less computer memory, and calculations are faster than for real numbers.

We learned that there are three types of variables: string, integer, and real numeric. The types are distinguished by a suffix character ending. String variables end with a dollar sign ($); integer variables end with the percent sign (%); and real numbers have no suffix ending.

Strings refer to alphanumeric data and can consist of any combination of letters, numerals and/or special characters (&, %, @, #, etc.). A string can have up to 255 characters in it. Strings are enclosed in quotation marks which, of course, do not print in the final readout. This presents a minor problem if you really want to print a quotation mark. The way around this is to print *two* quotes together as: " "I agree," " said John. This will print out as: "I agree," said John. If numbers are enclosed in quotes, they will be treated as strings. As we will see, this sometimes can be useful.

Integers

Integers are whole numbers with no decimal or fractional parts. Integers occupy much less computer memory, and calculations are faster than for real numbers. Your computer can store four integers in the same memory needed for one real number. Therefore you should use integers whenever possible. Like most things in life, you pay a price. They are limited to the range of minus 32,768 to plus 32,767. Just remember that good programmers use them consistently whenever they can.

Valid integers would include: 123, 4567, -89. Invalid integers would be 123.4 (because of the decimal fraction) and 45678 (because it is too large). The number 5.0 would be a valid integer because it equates to 5; however, you should avoid such numbers, because your computer must convert them to whole numbers before processing them.

It is even more important to know what happens if you assign a real number as an integer variable. For example,

---

John A. Libertine, The Four Corners, Hanover, MA 02339.

LET Number% = 123.45 *truncates* the real number to 123. A number such as 1.9999 would be truncated to 1, *not* rounded to 2. You should be very cautious in assigning integer variables for this reason. Ideally, you will never "mix" your numerics, but there will be times when you may want to do so deliberately. Just be certain you understand the consequences.

Real numbers (also called floating point numbers) give you much more flexibility than integers. In theory, you could enter a real number with 255 digits. In practice, CBasic real numbers have 14-digit precision. This means absolute accuracy for the first 14 digits. Or to put it in dollars, absolute accuracy, *to the penny*, for a trillion dollars. Beyond this, CBasic rounds off the 15th digit and drops the rest.

Just remember that the most digits you can print out in regular decimal format is 15 (with the final digit a zero in the case of whole numbers). For decimal numbers, the most will be 14 (with the last digit a round off).

Longer numbers will be printed out in exponential format (for example: 3.1234567890123 E 46). Except for rather esoteric scientific uses, you are not likely to outgrow 14-digit precision. For a comparison, some simple Basics limit you to fewer than six digits of precision! The 14-digit precision of CBasic puts it at the top of the ladder.

In addition to exponential notation, CBasic allows two other numeric forms (for integer data only). You are not likely to need either until you get into some very advanced uses, but you should know that binary and hexadecimal notations are available.

In general, CBasic gives you far more freedom with variables than other languages. For example, in most cases, if you mix integer and real numbers, CBasic will automatically convert them for you. There are some important exceptions which we will point out as we come to them. You still should avoid this if you can, since the conversion consumes both memory and running time.

You can almost forget there is a key word variable problem.

Keywords

You will also appreciate the advantages of CBasic when it comes to the use of *key words.* A key word is one used as a statement or function in the language. For example, AND, FOR, and PRINT are key words in most Basics and the use of such a key word even as part of a variable name will result in an error. Note that a variable like Total in most Basics will result in an error since TO is a key word.

In CBasic, only the variable To would cause a problem. As long as your variable is not *exactly* the same as a key word, you can use it.

There is one exception: FN as the first two letters in a CBasic variable indicates a user defined function (a very powerful CBasic advantage you will learn about later in this series). Thus, you cannot use FN as the first two letters in any variable. Aside from this, you can almost forget there is a key word variable problem.

Hierarchy Of Commands

We shall shortly write and run a simple program to illustrate the use of the variables we have discussed. Before that, however, we should point out that CBasic has a hierarchy of math commands which is similar to other Basics. The signs for addition and subtraction are the familiar plus (+) and minus (-).

For multiplication, you use the as-

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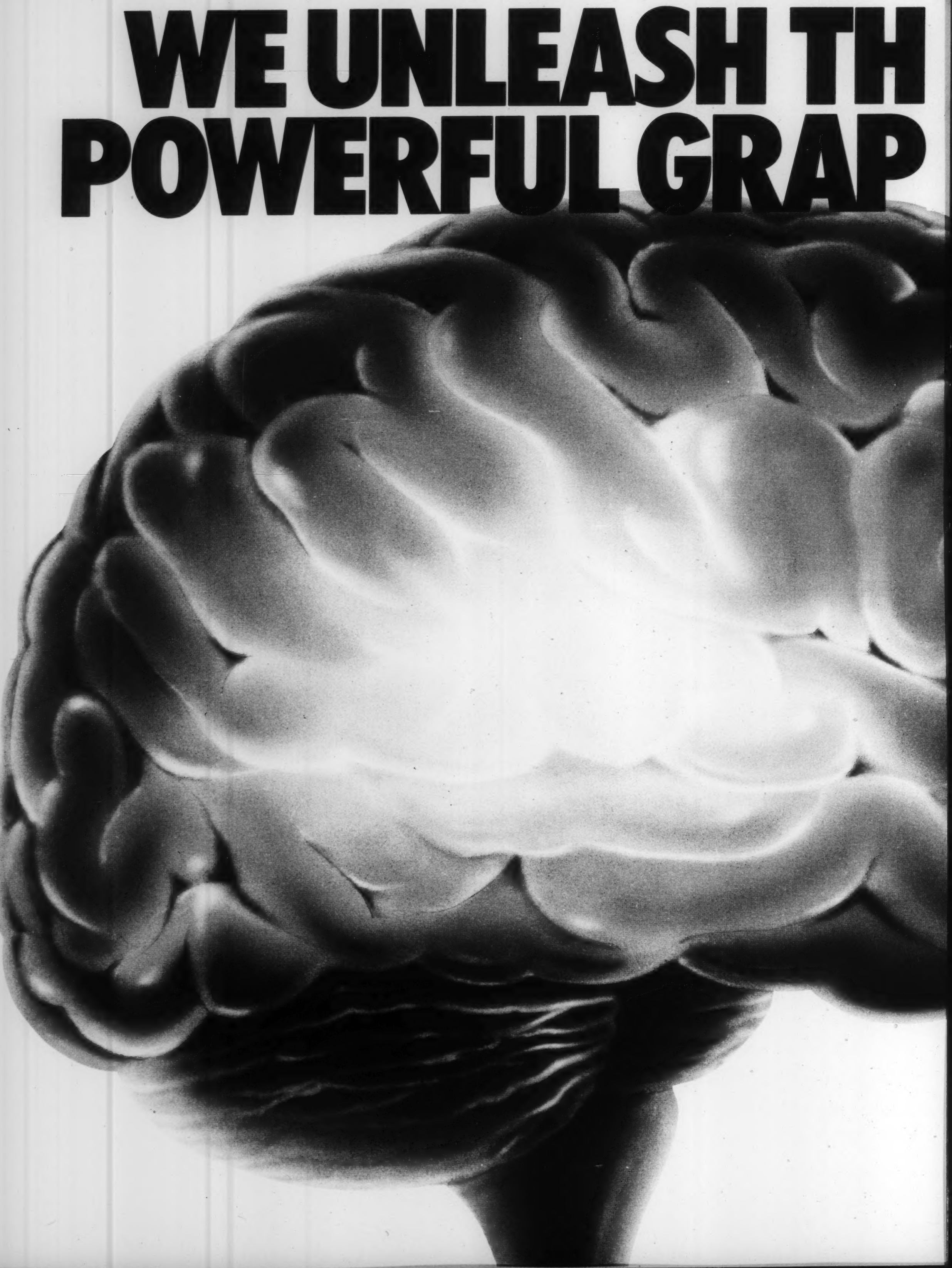
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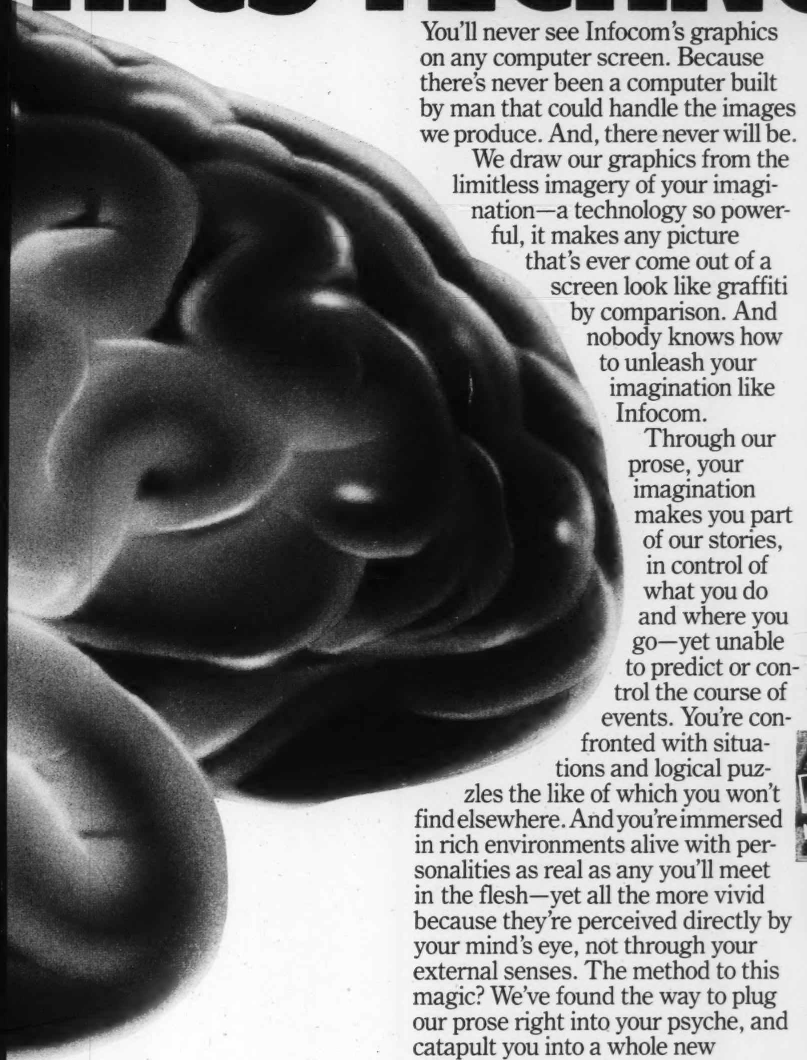

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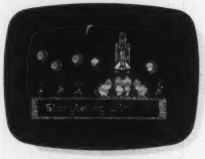

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terisk (*) and for division, the slash (/). If you want to raise to a power, the caret sign is used (on some computers, this will be the up-arrow sign). As in almost all languages, the simple formula A + B - C = D is turned around to D = A + B - C since we want to assign the result to the variable D. In other words, LET D = A + B - C. In this case, the math is done from left to right.

Now, let's take a somewhat more complex example: LET E = A + B * C - D. If we assign the numbers one through four to A through D, what is the answer? Going from left to right, we could assume: A (1) plus B (2) equals 3, times C (3) equals 9, minus D (4) equals 5. Run it through your computer and you will get the answer 3. Why? Because the CBasic hierarchy will require that multiplication be done *before* addition and subtraction. Thus it will multiply B * C (2 times 3) first then add A (1) to get 7 then subtract D (4) to get 3.

The order in which calculations are done is as follows: Exponentiation (raising to a power) is done first; next multiplication and division (left to right); finally, addition and subtraction (also left to right). There is, however, a way to modify the order.

For example, we can come up with the answer 5 in the above formula by changing it to read: LET E = (A + B) * C - D. See those parentheses around A + B? CBasic performs calculations within parentheses *first*. Then it goes back to do the rest of the calculations. In this case, it will add A + B (1 + 2) first, then multiply by C (3) to get 9, then subtract D (4) to get 5.

The computer will follow your instructions, so you must be sure you really know in what order the calculations should be performed. These are fundamental facts you must remember, so let's review it once more. The order of calculations is: 1) operations within parentheses; 2) raising to a power; 3) multiplication and division; 4) addition and subtraction. All operations are performed from left to right.

The proper use of parentheses is most important. You can, for example, have *nested parentheses* (parentheses within parentheses). In this case, the innermost operations are carried out first. Using the same numbers as before, what is the answer to: LET E = (A - (B + C) * D?

The answer should be -16. If you didn't come up with that, you had better re-read the paragraphs above.

There is an additional use for the plus (+) sign in CBasic. This is to add one string to another. Actually, the term is not add but *concatenate* and is used only with strings (alphanumerics). For example: if A$ = "One" and B$ = "Two" and C$ = "Three," then A$ + B$ + C$ would equal "OneTwoThree."

Here is another way to see the difference. 2 + 2 will equal 4. But "2" + "2" will equal "22" because the quotes have made the numbers into strings. You probably can't see a practical use for this right now, but it does come in handy at times.

The computer will follow your instructions, so you must be sure you really know in what order the calculations should be performed.

The program we are going to write will illustrate many of the features we have discussed above. To make the results look more professional, we want to clear the screen before anything prints on it. Later in this series, we shall see how to use control characters to do this efficiently. However, not every computer uses the same controls, so we shall use a roundabout way which has the advantage of working on any computer. We shall ask the computer to print blank lines over and over until everything has scrolled off the top of the screen leaving it blank.

Let's assume your computer has 24 horizontal lines. If it hasn't (some have 16), use the number of lines that apply every time you see 24. We could just print 24 blank lines this way:

```
PRINT
PRINT
PRINT
PRINT
etc. for a total of 24 PRINTS
```

Or we could put a colon between each PRINT (meaning the next instruction goes on the following line) as follows:

PRINT:PRINT:PRINT:PRINT: (24 times)

But we are going to use a much more efficient way: a FOR-NEXT loop. If you are familiar with Basic, you will see that it works very much the same in CBasic. It you are not, just type it out for now and we shall explain in a moment. At the same time, we are going to add another FOR-NEXT loop immediately below the first. This one will cause the program to pause (when the screen is blank) before proceeding. This is a frequently used device in programming and is sometimes quite impressive.

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```
REM Sample program illustrates variables and
REM use of strings, integers & real numbers
LET Word.1$ = "January"   REM assign string
LET Word.2$ = "February"  REM to variable
LET Word.3$ = "March"

LET Number.1% = 100 REM assign number to
LET Number.2% = 200 REM Integer variable
LET Number.3% = 300

LET Real.1 = 123.45 REM assign real number to
LET Real.2 = 234.567 REM numeric variable
LET Real.3 = 345.6789

FOR INDEX% = 1 TO 24  REM Clear Screen
PRINT
NEXT INDEX%

FOR PAUSE% = 1 TO 3000   REM Time Delay
NEXT PAUSE%

REM Screen print-out routines
PRINT "The first month is ";Word.1$
PRINT "The second month is ";Word.2$
PRINT "And the third is ";Word.3$
PRINT        REM space here
PRINT Word.1$ + Word.2$ + Word.3$ REM concatenate
PRINT                             REM 3 strings
REM integer arithmetic
Answer.1% = Number.1%*Number.2%+Number.3%
Answer.2% = Number.1%*(Number.2%+ Number.3%)
Answer.3% = (Number.1%*Number.2%)+Number.3%
REM Answer.3% should be same as Answer.1%
Answer.4% = Number.1% ^ 2    REM exponentiation
PRINT Answer.1%
PRINT Answer.2%
PRINT Answer.3%
PRINT Answer.4%
PRINT
REM Real Numbers arithmetic
Total.1 = Real.1 + Real.2 + Real.3
Total.2 = Real.1 + Real.2/Real.3
Total.3 = (Real.1 + Real.2)/Real.3
PRINT Total.1
PRINT Total.2
PRINT Total.3
REM Note above that Total.3 and Total.2 should
PRINT    REM                     NOT be the same!
REM Combined string & number output
PRINT Answer.4%;"units were sold in ";Word.1$
PRINT "for a profit of";Answer.1%;"dollars"
PRINT
PRINT "This concludes test program VARIABLE.BAS"
REM No need to put in "END" line.  CBASIC does
REM                            this automatically.

A>
```

Listing 1.

Entering The Program

Take a look at the program in Listing 1. Note again that we don't use line numbers in CBasic. Type the program on your word or text processor exactly as printed. Be especially careful to type commas, semicolons, and colons exactly, and note spacing within a string. Frequently, there is a space before the final quotation mark. Now, store the program. Let's call it: VARIABLE.BAS (don't forget the .BAS).

Now be sure your CBasic programs (CBAS2.COM and CRUN2.COM) from our first session are on the same disk as the new program and proceed to compile by typing: CBAS2 VARIABLE (the .BAS extension is assumed; you do not have to type it).

If you have entered your program correctly, the note "No errors detected" will appear at the bottom of the screen. If there are errors, you must go back to your text processor, correct them, and compile again. The most likely errors will be misspelling a key word (PRNIT instead of PRINT), leaving out a quotation mark at the end of a string, or omitting a closing parenthesis.

Once the program compiles with no errors, type in the command to run the program: CRUN2 VARIABLE. The screen should clear and remain blank for about five seconds. Then you should get the readout shown in Figure 1. If you do not, check your program. Did you type the numbers incorrectly or leave out or misplace a parenthesis or a quotation mark?

You may very well think this program doesn't do anything and, of course, you are right. It is intended only to illustrate the use of variables. In our next session, we shall start writing programs that accomplish things. As you go on, you will write your own programs to solve problems or set up useful procedures. Before that can happen, you must learn the rules of the road so be patient for now.

Before we end this session, let's take a look at the two FOR-NEXT loop functions used in the variable program. It is a very frequently used and powerful tool in any Basic. Think of it as meaning "FOR every given number of times I tell you to, do this thing until you come to the word NEXT and start over again." In these simple examples, we are asking the computer to print a blank line 24 times and to pause before continuing. Figure 2 is a line-by-line explanation of the first loop.

The next loop is even simpler. We set

Figure 1.

```
CRUN2  VARIABLE

CRUN VER 2.08
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     (SCREEN WILL CLEAR & "PAUSE" HERE)




The first month is January
The second month is February
And the third is March

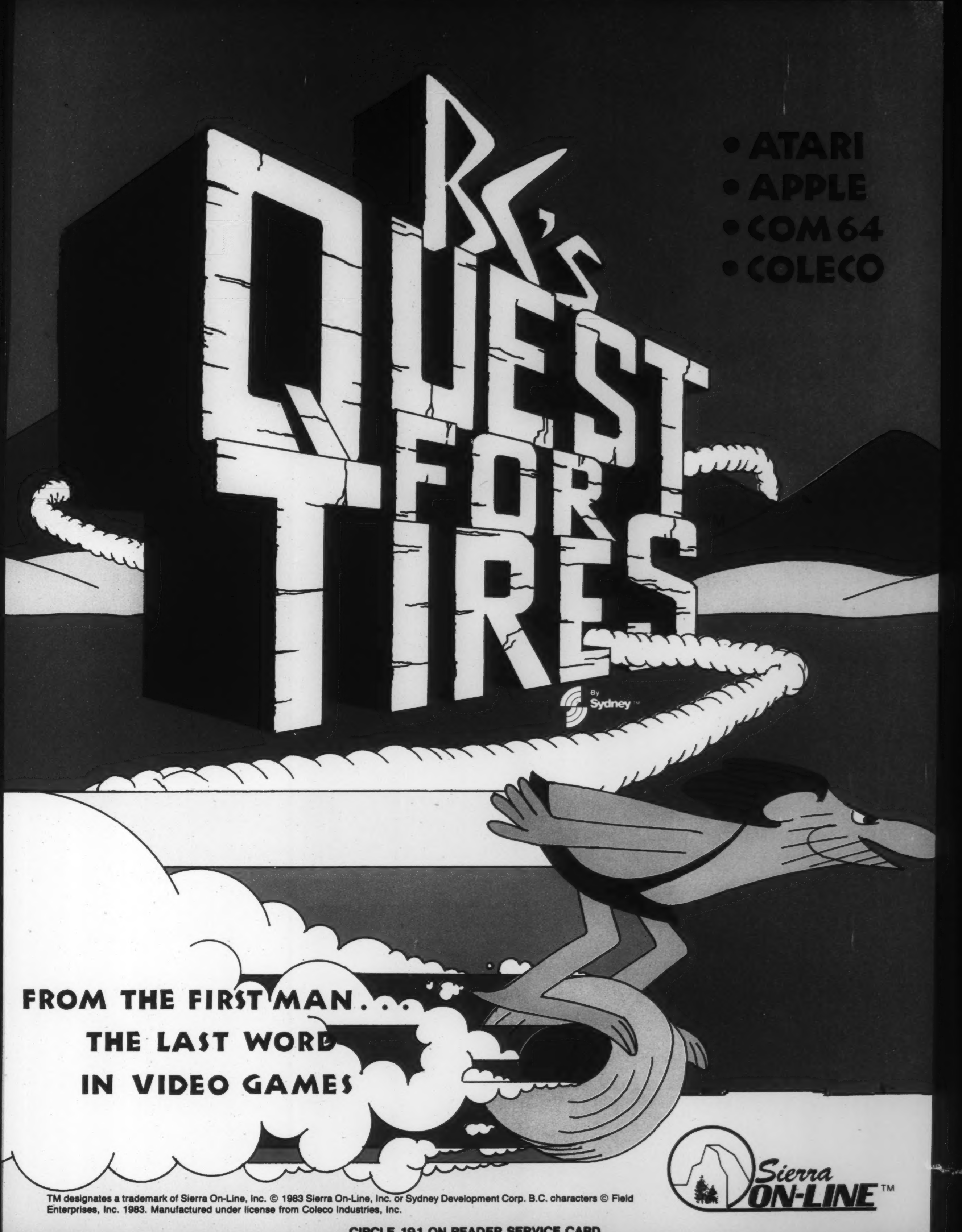
JanuaryFebruaryMarch

 20300
-15536
 20300
 10000

 703.6959
 124.128569042
 1.03569237231

 10000 units were sold in January
for a profit of 20300 dollars

This concludes test program VARIABLE.BAS
```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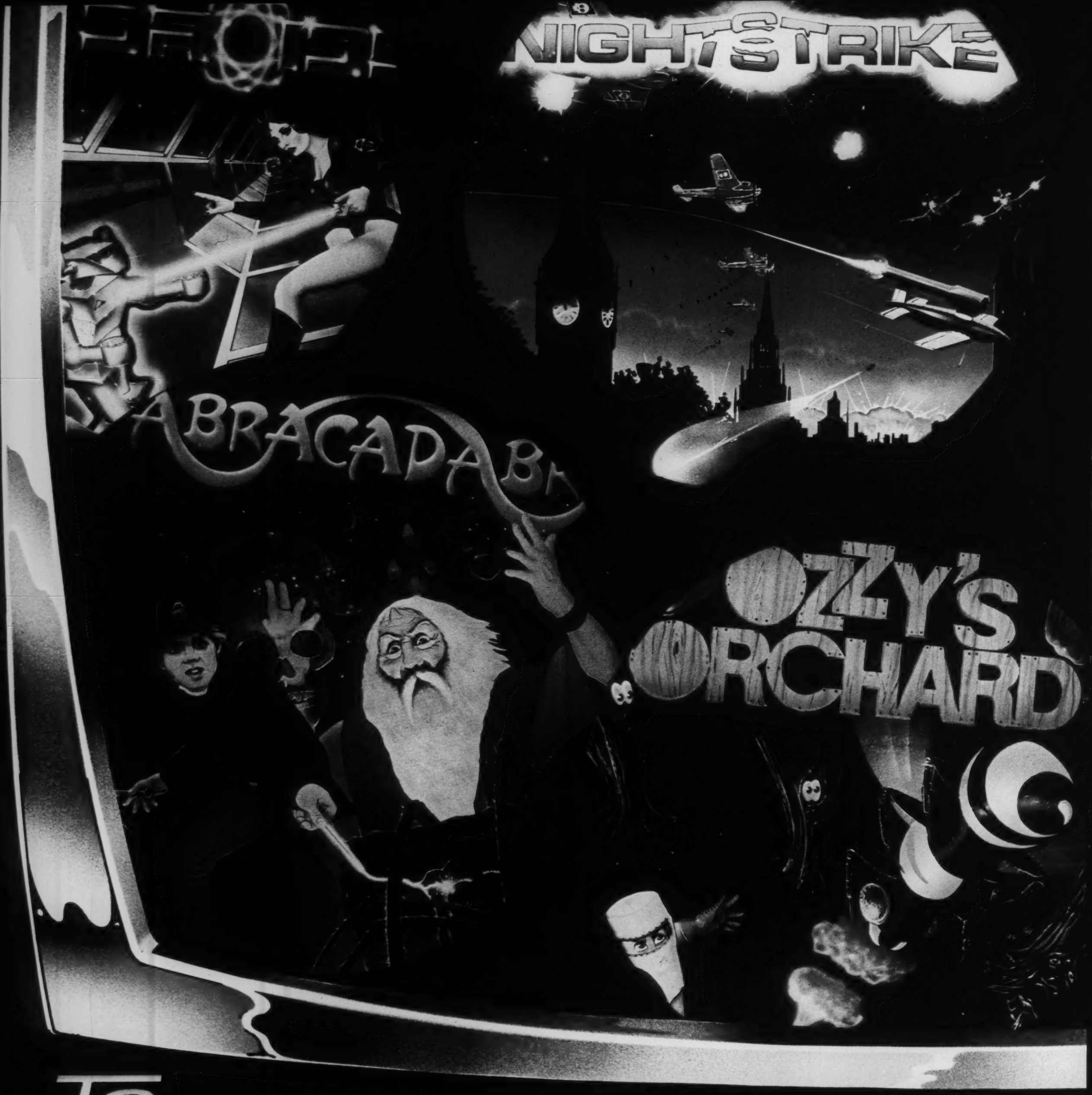

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CBasic Clinic, continued...

FOR INDEX 1 TO 24	(The integer variable INDEX% is set to start at 1 and end at 24.)
PRINT	(Print a blank line)
NEXT INDEX%	(Increase the value of INDEX% by 1 and go back to the beginning of the loop. If the value of INDEX% is equal to 24, do *not* go back to the beginning but go to the next program line.)

Figure 2.

up a loop to be processed 3000 times (this figure might have to be changed depending on the speed of your computer). Since there are no instructions between the set-up and the NEXT line, the loop does nothing. However, the computer must still look for *what* to do 3000 times. This takes time, hence the pause.

Many times FOR-NEXT loops are used as a *subroutine.* You might, for example, want to clear the screen many times during a program run. Rather than re-type the loop over and over, we put it in the program once and refer to it in a GOSUB statement. In this case, the loop would have a line number at the beginning and a RETURN line after it to take the program back to where the GOSUB left off. We shall go into GOSUB (and GOTO) uses in much more detail in our next session.

In the meantime, play with the program listed here. Make changes in both the string and numeric variables. See what happens when you move the parentheses in math formulas. Try changing the 3000 figure in the pause loop to 1000 and to 6000 to see the difference in time. Just remember that these are fundamental statements and functions in CBasic so you should understand them thoroughly and be very familiar with their uses and variations.

Also, try changing the spaces before the end of a string. Take it out in one place and add several extra spaces elsewhere (as in "One ", for example). Also try putting one or more spaces after the first quotation mark in a string (i.e., "   One"). The results will be quite different. More important, you can use this method to format your printouts (whether on the screen or your printer). For example, in the concatenation of strings, you can get the printout to read:

One Two Three

(instead of OneTwoThree) by simply inserting spaces as:

A$ = "One"   B$ = "Two"

No space is needed after "Three," of course.

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Ernest E. Mau

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Many recreational and professional computer users overlook or ignore conditions that contribute to unnecessary failures and malfunctions. You can minimize these conditions to extend the operating life, improve overall performance, and reduce repair costs. Specifically, the areas of concern are dirt and contamination, excess heat, stray magnetic fields, electrostatic charges, power disturbances, and mechanical wear.

Dirt and Contamination

Anything existing outside a sealed environment gets dirty, if only from airborne dust and contaminants. This includes computer systems; dirt is the mortal enemy of any system.

A few years ago, most computers were housed in special rooms where temperature and humidity were regulated, air was filtered, and activities such as smoking, drinking and eating were prohibited. In large corporations using mainframes, you still find glass rooms, walled off from the rest of the world.

With the advent of the personal computer, however, machines have been moved into open, uncontrolled environments. The new breed for homes, professional offices, stores, and similar installations had to be accessible to people, with a corresponding increase in problems resulting from dirt and contamination.

Modern microcomputers are exposed to dust, smoke, soot, chemical pollutants, fine particulates known as "aerosols," and corrosive gases, with little or no thought about the effects. There are no totally clean offices or homes. The average office is full of cigarette smoke, urban pollution, and dust. The average home has airborne cooking grease, pet hairs, and carpet fibers, among other unsavory things in the air.

Add particles of human hair, dandruff, upholstery fibers, and bits of food, and you begin to understand what the computer must endure. More problems are particles of printer paper, oxide from tapes or disks, and fibers broken loose from printer ribbons.

Computer equipment cannot be airtight. Components generate heat and require a continuous flow of cooling air provided by either natural convection or fans. Because more air flows through fan-cooled machines, they collect more internal dirt than convection-cooled ones and generally require more cleaning and care.

Effects

Dirt can cause anything from a gradual decline in performance to outright failure, and problems often build slowly until a malfunction occurs.

When was the last time you cleaned your computer?

Dirt on outer surfaces usually isn't serious. Dirty screens are hard to read. Dirty keys feel strange; dirty covers are unsightly. External surfaces are cleaned easily, however, and cause few operational difficulties.

Dirt inside the system is a serious problem. Though contaminated drives and disks aren't readily spotted, they show up as data misreads (I/O errors), head "crashes," damaged disk surfaces, or random intermittent errors.

Dirt blocking the cooling air allows heat to build up, leading to damaged components and costly repairs. Contaminated connectors (cable and circuit board) and switches can fail to make good contact or can make and break contact intermittently. Even the telephone plugs of modems and other communications devices can be contaminated, leading to data transmission errors and the loss of expensive network time.

Furthermore, some contaminants are conductors, creating unwanted electrical paths and short circuits. Graphite particles from pencils, soot, metallic chips, and magnetic oxides are particular problems.

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Illustrated Alaskan Moose.

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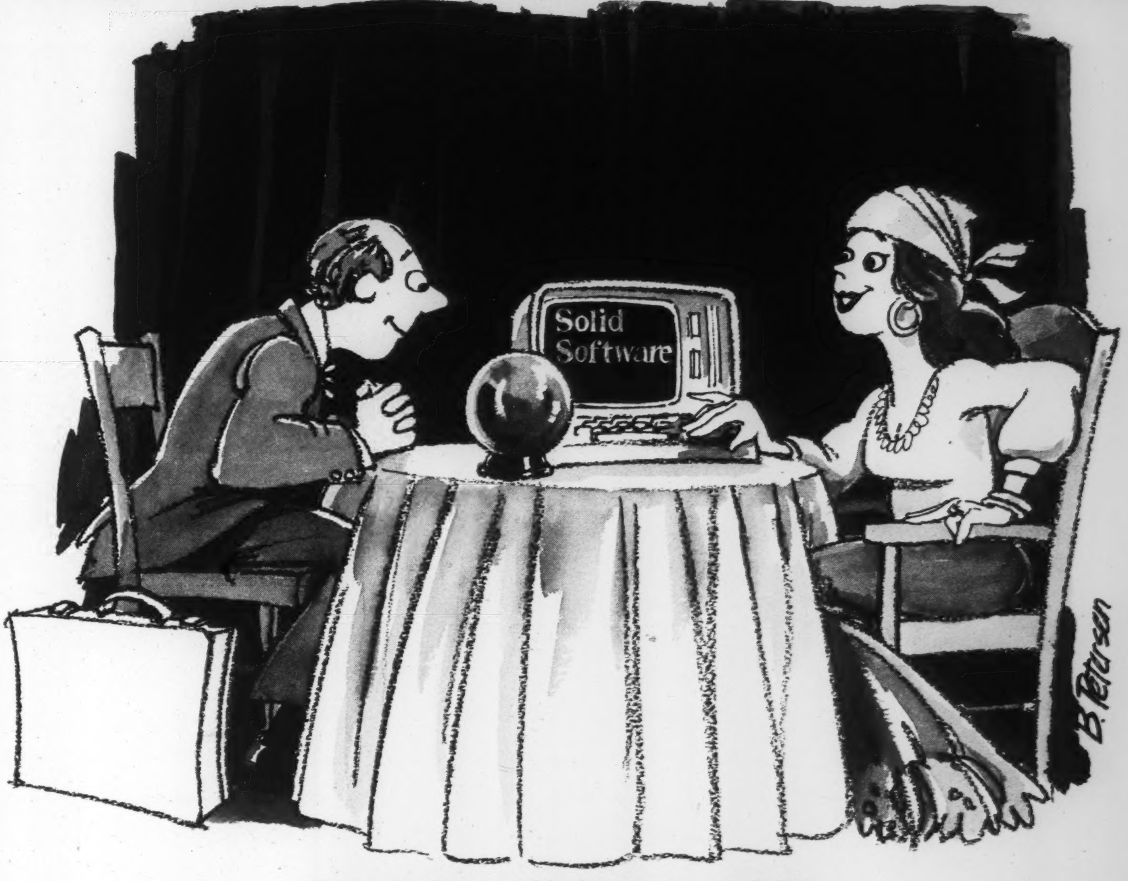

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Preventive and Remedial Steps

The best cure for dirt-related problems is prevention, primarily through regular inspections and cleaning.

On the installation level, replace filters on forced-air heating and cooling systems every two or three weeks. In dry climates, install a room or furnace humidifier to reduce both airborne contaminants and static-electricity problems. Portable room-air filtration devices also help, but the filters must be changed frequently. Furthermore, such units must be kept several feet from the computer and magnetic media to avoid potential problems from electromagnetic fields.

Beware of auxiliary heating devices, especially kerosene heaters and wood stoves. Even the most efficient kerosene heaters emit a kerosene mist. When the mist condenses on surfaces, circuit boards, chips, disks, tapes, and screens, it leaves a greasy, conductive film that can do immeasurable damage. As a rule, if you own a computer, don't use a kerosene heater anywhere in the same building. Similarly, wood stoves are "dirty" devices that lead to the unavoidable spread of ash, smoke, and dust. Though not as damaging as a kerosene film, these contaminants must be removed from both the outside and inside of the computer, perhaps as often as three or four times a week.

Clean your installation, system components, and surrounding area every week. Vacuum the floors, baseboards, window sills, and furniture. Wipe down desk or table tops, component casings, and other exposed surfaces with a soft, damp cloth or a commercial cleaning product intended for computer use. Be certain the cleaning cloth is damp, not wet. Avoid detergents—they leave residues that later cause more contamination. Avoid chemical solvents, particularly degreasing chemicals—they can damage components.

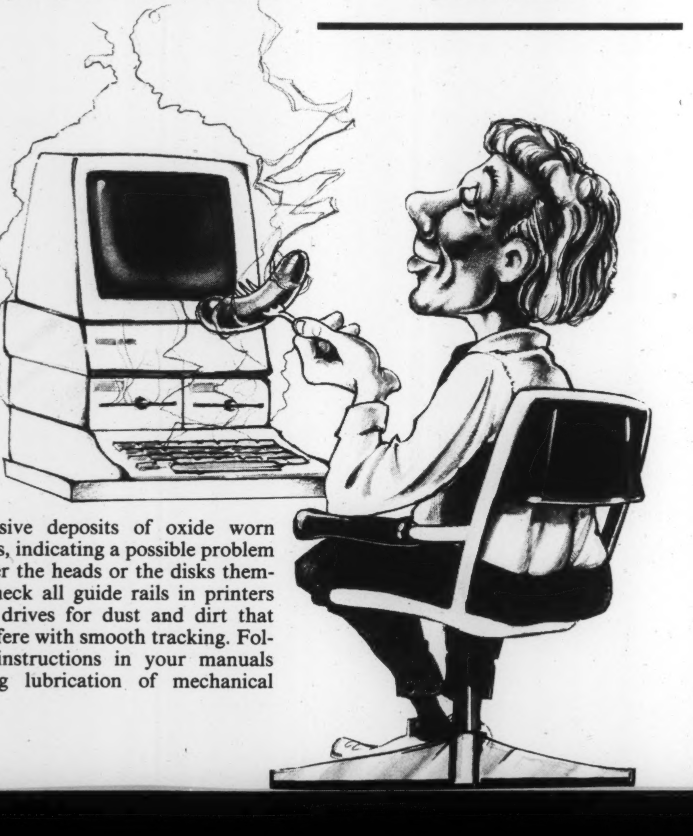
Make use of the many cleaning products available for computer and electronic equipment. Screen-cleaning solutions, pressurized clean-air canisters, and lint-free cloths are essential for proper care of your equipment. Make a special point of obtaining and using a disk-drive cleaning kit, preferably one that contains a special disk and solutions so that drive heads can be cleaned simply by inserting the disk and activating a drive for 30 seconds or so. It voids your warranty or service contract to open drives and clean them with swabs.

Inspect all air vents and intakes, giving special attention to filters and fan housings where screens or filters may block the air flow. Replace or clean filters and screens in accordance with the manufacturer's recommendations.

Check the cables to printers, terminals, disk drives, and modems. A common cause of system failures and communication problems is a loose connector, and many connectors work loose simply from the normal operating vibration of fans, disk drives, and printers.

At least once a month, inspect the inside of your equipment chassis, assuming of course you can open it without endangering a warranty or service contract. Be sure power is off and the power cord disconnected before opening anything, then remove the covers and look for accumulations of dirt and dust. Remove any such accumulations, especially around boards and connectors. Tweezers and a canister of pressurized clean air are useful tools for removing dirt. Do not reverse the hose of a vacuum cleaner and use it to blow into a device—if you have tried reversing a hose, you probably have seen puffs of dirt and dust emitted, and the last thing you want is to introduce that dust into your equipment.

Check mechanical components for evidence of wear. Look for worn spots on moving surfaces inside printers, especially on the rails and bearing surfaces of the printhead and print hammer. Be sure to clean paper chips and accumulated paper fibers from inside the printer. If the disk drives can be opened, check the rails on which the heads ride, and look for "burn marks" and abrasions on the magnetic heads. Also look for excessive deposits of oxide worn from disks, indicating a possible problem with either the heads or the disks themselves. Check all guide rails in printers and disk drives for dust and dirt that may interfere with smooth tracking. Follow the instructions in your manuals concerning lubrication of mechanical parts. If your manuals don't cover care and maintenance, contact the manufacturer and request or purchase a service manual.

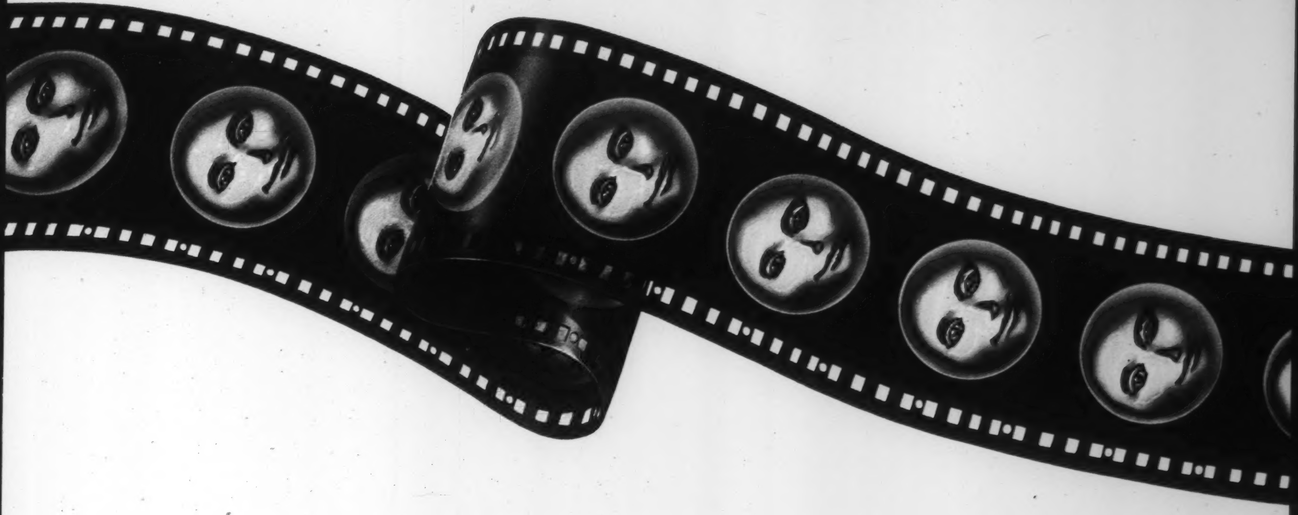


Once or twice a year, be prepared to strip, clean, and reassemble your equipment—or pay a technician to do it for you. Remove circuit boards and clean the edge connectors and sockets. Check the seating of all integrated circuits. Check the seating of all cable connectors. Remove the keytops from the keyboard and clean out accumulated dirt. Basically, perform a minor overhaul.

Heat Buildup

Heat buildup is a sneaky hazard that catches unwary users by surprise. All equipment has manufacturer-specified operating and nonoperating temperature ranges that must be observed. In general, personal and small-business computers and peripherals can operate successfully under ambient temperatures from 50° F to 80° F (10° C to 26.6°). That range covers the limits of normal operator comfort, typically 65° F to 78° F (18° C to 25.5° C). It is important to maintain the operating environ-

Heat buildup is a sneaky hazard that catches unwary users by surprise.



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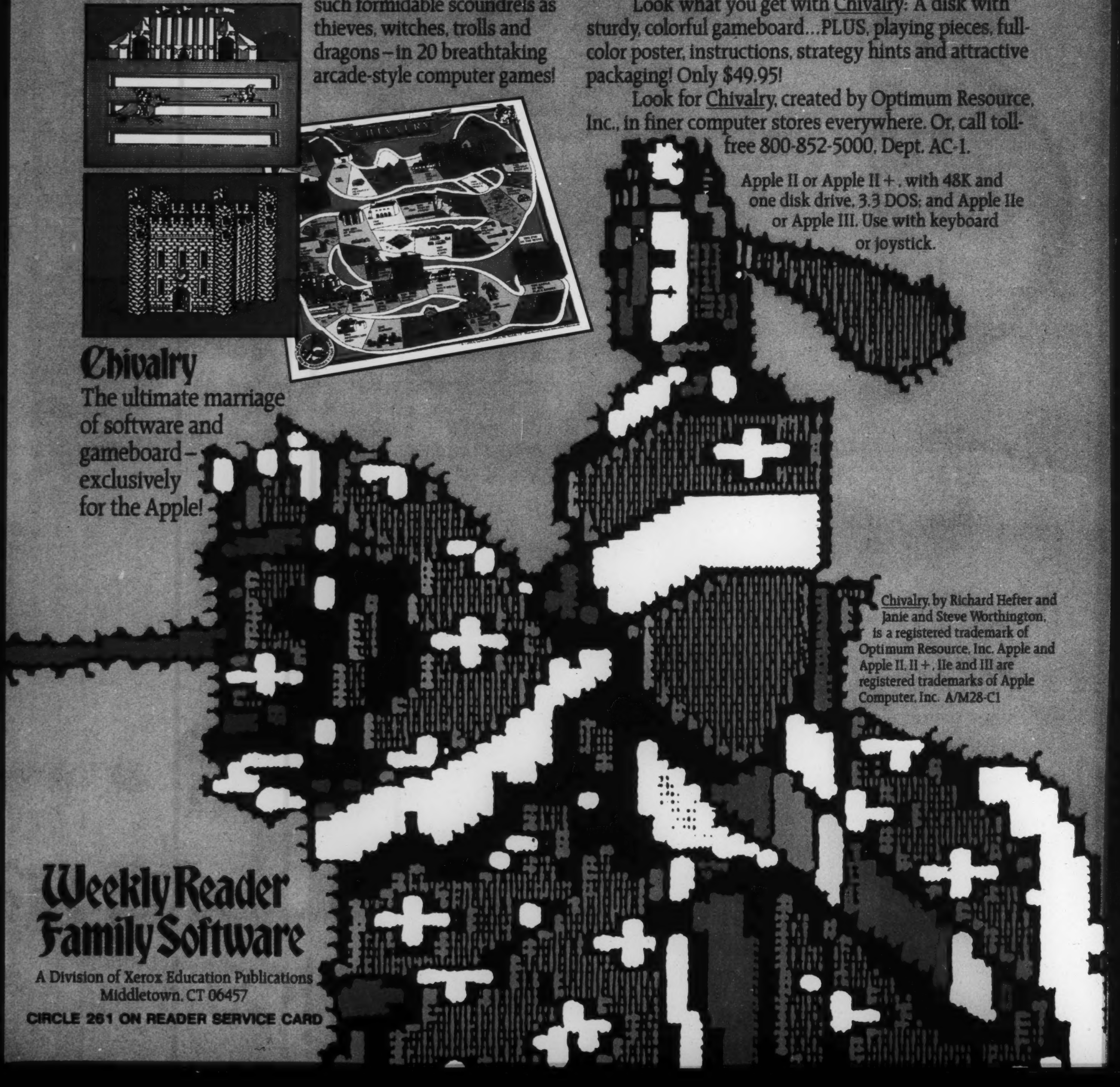

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CIRCLE 261 ON READER SERVICE CARD

ment within the specified range. If the temperature is too low, mechanical actions such as disk accesses and printing may become sluggish. If too warm, overheating may cause improper operating and anything from a total shutdown to intermittent errors.

Remember that electronic and mechanical devices generate heat, which, if not vented or cooled, can cause internal temperatures to exceed the ambient temperature. It is the internal temperature that causes difficulties, and it must be controlled so that the equipment can function normally. Often it is necessary to install special cooling devices on the equipment. Slotted covers and auxiliary fans may be necessary to maintain satisfactory operating temperatures.

Particular heat problems occur when plug-ins are added to computers, with each unit adding its own heat to the total and possibly exceeding the cooling level for which the unit was designed. With smaller machines, the situation is compounded by vertical component stacking, where disk drives are placed on top of the computer and a monitor is on top of the drives. That creates a vertical heat column, in which upper units block the cooling of lower ones, while lower units add to the heat built up in higher ones.

The usual cause of excess heat is blockage of air intakes. Such blockages result from installing a unit having left insufficient air space around it, placing something over the vents, or allowing dirt deposits to collect on filters or screens. Internal dirt also blocks the flow of air around critical components.

Never install computer equipment above or near heat sources. Stay at least three feet from heating vents or radiators. Keep at least six feet from auxiliary space heaters, including electrically powered radiant heat panels and stoves. Because of the double threat from heat and contamination, don't put the computer in the same room with a kerosene heater or wood stove—preferably not in the same building.

Less obvious is the danger from direct sunlight. Sunlight striking the machine generates heat beyond the levels with which the cooling air flow can cope. Heat radiated by window glass, drapes, carpets, and furniture exposed to sunlight adds more problems. Furthermore, sunlight can warp disks and magnetic tapes, leading to loss of valuable data.

Devastating Effects

Often, the first sign of a heat problem is erratic operation, including numerous errors during data processing. Extended exposure to excess heat shortens the life of circuit chips and other components, eventually leading to more failures under various operating conditions. The cumulative effects can be devastating and expensive.

According to one report, "Studies have shown that the life of electronics equipment is cut in half for every 10° C rise in temperature. So if you keep your . . . computer 10 degrees cooler, you double its life and also increase its reliability during normal operation."[1]

Preventive and Remedial Steps

No system should ever be damaged by heat since heat problems can be prevented. By keeping the equipment away from sources of direct heat and out of direct sunlight, you have most of the problem licked. If you like to look out the window while you work, consider putting a commercial reflective window film on the glass in the computer area. Bronze- or silver-tone reflective film is inexpensive compared to computer failures; it's easily installed, and it substantially reduces the heat generated by direct sunlight. However, don't rely totally on reflective films—some heat gets through; so draw the drapes as often as you can.

Keep the equipment clean, both inside and outside. Take care not to obstruct air intakes, vents, fan inlets, and other openings, either by placing something in the way or allowing dirt and dust to accumulate.

Third, allow sufficient space for free air flow. Never jam a unit up against a wall or set it on a soft surface like carpeting. Even foam vibration pads are dangerous to components having air intakes on the bottom (the "feet" sink in and the clearance to the bottom is reduced).

Don't stack components vertically; instead spread them out horizontally. That avoids concentrating the rising heat and creating an additive thermal column that easily overheats the uppermost units. I don't care for most commercial workstations used to house systems in a minimum area, because many of them concentrate the heat sources while they block the free flow of cooling air.

Install additional cooling whenever possible. Be especially alert to auxiliary fans marketed for units normally cooled by convection. Often potential heat problems aren't evident until the system has been on the market a while and manufacturers begin providing plug-ins. Then someone sees a heat-related failure and realizes that convection cooling isn't adequate for a fully-equipped unit or that the cooling fans have been undersized. The appearance of auxiliary fans on the market for a specific brand of equipment indicates that extra cooling is required.

Electromagnetic Fields

Magnetic or electromagnetic fields are hazardous because they can disrupt computer operations, alter data being processed, and erase magnetic storage media.

Every electrical current and, thus, every electrical or electronic device generates an electromagnetic field—some weak, others strong. Motors, bells, buzzers, and transformers contain electromagnets, and some also have permanent magnets. All have electromagnetic fields. Even computer components generate fields, including ribbon-lifters of printers, disk drive motors, and transformers in monitors and terminals. Furthermore, loose ferrous (iron-based) metal objects may be magnetized, including screwdrivers, pliers, wrenches, tweezers, scissors, paper clips and staples.

Effects

Like other hazards, the effects of stray magnetic fields are unpredictable, showing up as drive failures, memory losses or alterations, garbled data, garbaged printouts, pulsating displays, unexpected

Protect your magnetic media at all costs.

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[1] "Frequently Asked Questions about VENTOP," unpublished report (1982), Tovatech, 1903 Fordham Way, Mountain View, CA 94040.

breaks or transmission errors in network communications. The most damaging is erasure of magnetically stored data. Interference with electronic operation is transient and generally causes little or no permanent damage to hardware, but lost data can be expensive.

Preventive and Remedial Steps

Most problems with electromagnetic fields are avoidable. Remove the source of the field and the problem is gone. It is difficult to know which item causes the problem, and people tend to overlook the obvious.

One offender is the phone. Because its bell operates with a powerful electromagnet, putting the phone next to a box of disks could damage the contents of the box when the phone rings. Similarly, placing the phone near disk drives or memory circuits may interfere with storage and processing operations.

Audio speakers are a source of trouble for people who like music while they work. Speakers have powerful magnets to move the cones. In turn, the magnetic fields damage disks, tapes, memory contents, and read/write operations if not located a sufficient distance away.

Just moving offending devices three to six feet from the computer is usually sufficient. But be careful not to put them where you could walk through a field with a disk or tape in your hands. In general, keep anything not required for computer operation away from the machinery, including tools, flashlights, intercoms, and any other device of metallic nature or which operates from an electrical outlet.

Be careful of video terminals and monitors, reserve power supplies, and similar devices. They often contain powerful transformers with fields that can devastate memory storage and mass media quickly. Some tape and disk devices are particularly sensitive and cannot be run within two or three feet of a CRT or monitor. That's another reason for not stacking a monitor on top of disk drives—the transformer can prevent proper read/write operation and can even erase disks while they spin in the drives.

If a device cannot be relocated, try shielding it from the other components with a thin sheet of soft iron or carbon steel. Often such an insert is sufficient to block the magnetic field and protect the sensitive components. Protect your magnetic media at all costs. Store tapes and disks in dust-protective jackets and boxes at least three to four feet from any electrical or electronic device. Never leave magnetic media on top or beside the computer, drives, monitor or CRT, or printer. Never allow them near the telephone, speakers, calculators, or similar gadgets.

Power disturbances are the biggest pain of all.

Electrostatic Charges

Static electricity, a constant problem around computers, is always a potential source of malfunction. A good description of the phenomenon is provided by The Static Control Systems division of the 3M Company:

"In scientific terms, it is an imbalance of electrons on the surface of a material. Whenever two materials that are in contact are separated, an imbalance of electrons occurs each surface, resulting in a positive charge (deficiency of electrons) on one surface and a negative charge (over-abundance of electrons) on the other surface. Because this charged state is 'unnatural,' each surface makes an effort to discharge, or return to its neutral state. A typical example . . . is a person walking across a floor (generating a static charge) and then getting a shock (discharging) as a door knob is touched. Quantitatively, when a person feels this shock, a charge of at least 2500 volts is involved, a charge level high enough to cause malfunctions of electronic equipment . . . charges well below 2500 volts can cause equipment malfunctions, so static protection may be needed even though 'shocking' is not present."[2]

All floor surfaces are potential problems—carpeting, vinyl tile, wood, and concrete. Furthermore, moving objects such as the flywheels and diskettes in continuously spinning disk drives are internal sources. Even paper moving through a printer can build and carry a charge.

Eliminating carpeting doesn't cure the problem. The 3M Company report cites experimental work done at Western Electric Co., determining that the most common buildup for a person walking across a carpet was 12,000 volts; walking across a vinyl tile floor under the same environmental conditions accumulated 4000 volts. The highest readings reported were 39,000 volts for carpeting and 13,000 volts for vinyl tile. Carpeting generates higher voltages, but solid floors still generate enough to be dangerous to delicate equipment.

Contrary to popular belief, high humidity does not eliminate static. Although high humidity reduces charges and danger, it does not get rid of static.

Static Damage

The most obvious static effect is a spark from one object to another. But even when arcing isn't evident, static can damage the inside of electronic devices or data stored on magnetic media.

Static can alter or wipe out the contents of memory, generate faulty data, blank a video display, cause unwanted

[2] Robert J. Kunz, "The Solution to Static Caused Problems with Commercial Electronic Equipment: 3M Static Control Floor Mats," Report J-SFMP(501)R1, Static Control Systems/3M.

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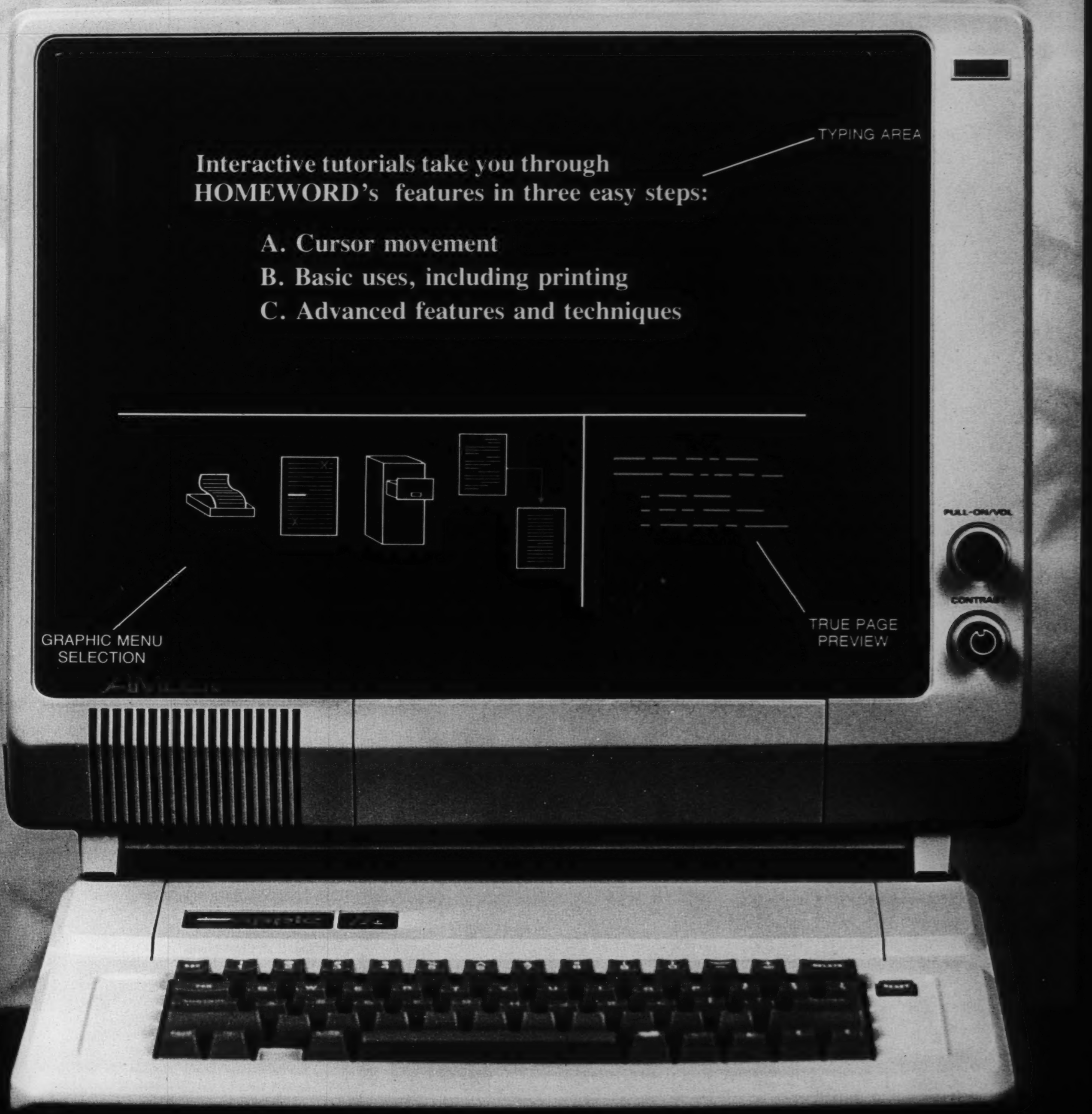

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printer carriage returns, and create a host of similar problems. Worse, static discharges can burn out circuit chips or entire circuit boards. A discharge to magnetic media can permanently destroy data or even damage the magnetic surface.

Interface cables are particularly vulnerable. Sometimes cables have to be routed where it is possible to step on them. Simply walking across the floor can discharge static into the cables, thereby "clobbering" the devices at either end. This can lead to lost data, blown circuit chips on interface boards, fuse failures and system shutdowns, or damaged circuit boards. In network communications, the cords that connect the computer and the modem are entry points for static that disrupts the communications, garbles the transmissions, and generally incurs increased time and charges for the network use. At worst, static penetrating a telephone cord could damage the modem itself or the computer to which it is connected.

Expect static to cause erratic computer behavior at all levels from disk operations through network communications. Be alert to the possiblity even if you don't see any sparking; if you get a spark when touching the equipment, you have a problem that has to be eliminated.

Curing Static

The best cure for static is prevention. Ensuring that every component is grounded serves as a good first step, but it isn't foolproof. Be certain the third prong (the round one) of every line plug is properly grounded. Don't attempt to defeat the grounding by cutting or bending the prong and don't attempt to use two-prong adapters without connecting their pigtail wires. If you have any doubts about the electrical grounds in your building, it pays to have an electrician check or install them before you hook up your computer system.

Other steps that reduce but don't entirely eliminate static problems are removing carpets and rugs from the working area, installing a humidifier, avoiding crepe or rubber soled shoes, and avoiding excessive movement such as shuffling your feet while working.

Connecting cables should be routed so that they can't be stepped on or touched. Putting them under a carpet may help avoid tripping, but static discharges can penetrate the carpet to reach the cable and connected electronics.

Sometimes commercial anti-static sprays are helpful in cutting down short-term problems, but they must not be sprayed directly onto the keyboard, screen, or magnetic media. The residue left behind could cause problems later. Some sprays irritate the eyes, so be careful where and how you use them. Remember, you will have to repeat the treatment periodically: vacuuming the carpet or wiping the desk surface removes or degrades the antistatic protection.

You can achieve effective, long-term solutions to static problems with anti-static floor mats placed under chairs, behind counters, and in other locations where people walk and come in contact with delicate electronic devices. They are also useful on top of connecting cables (between devices and to communications modems) as a means of preventing discharges into the cables. Conductive anti-static mats must be connected to a good ground to be effective, usually to the center screw of a grounded wall receptacle. Sitting or standing on such a mat then grounds static built up while you walk to the installation and prevents buildups while you move around at the equipment.

Power Disturbances

Power disturbances are the biggest pain of all, both to stand-alone computer operations and network communications. If the lights don't go off completely, low voltages (brownouts), surges, spikes, line noise, and other problems wreak havoc with computer operations and data transmissions. Basically, there are three major types of disturbances: power outages, voltage fluctuations and line noise. All are disruptive and all can be destructive.

Did you know that you are the one responsible for providing appropriate power and installing protective devices? Did you know that failure to condition your power lines can be considered negligence and cause for voiding warranties or canceling service contracts? Did you know that neither the manufacturer nor the retailer is responsible for problems resulting from your failure to meet power specifications?

It is common to receive line power above or below the maximums and minimums specified for a piece of equipment. If the specification calls for 115 VAC nominal with a maximum of 130 VAC, utility lines carrying 131 VAC are "out of spec," and it is your responsibility to detect the condition and do something about it.

Most power disturbances originate on the utility lines, resulting from causes as diverse as power switching, damage to underground cables, lightning strikes on lines and transformers, and auto accidents knocking out distribution boxes. Of course, you can overload a circuit and blow a breaker or fuse, create interference or noise with appliances, or generate other problems of your own, but the most serious and the most difficult to control begin outside your installation.

There can be a sudden failure without warning.

Sudden Shutdown

One effect of a power outage or blackout is a sudden shutdown of the computer system, losing programs and data in memory and whatever results have been computed to that point. That is typical of interruptions lasting more than a few power cycles. Shorter interruptions cause glitches which in turn cause erroneous results or data transmissions, alter programs, trash displays or printouts, disconnect network links, and so on.

Those are just operating errors; much worse can happen. A high-voltage surge can figuratively "fry" equipment, burning out circuits or entire boards. Internal power supplies can burn out. Mechanical parts can jam, with the possibility of severe damage. Disks can crash, possibly damaging heads or magnetic media. If the magnetic medium isn't physically damaged, stored data may be erased or altered. Files may be irretrievable.

Not only are power disturbances damaging to the system, you can't predict, prevent, or control them. You can, however, spend the time and money to protect the most vital components and operations against them.

Providing Protection

You are the only one who can determine how much protection you can afford, how much your applications justify, and which of several alternatives is suitable. For instance, recreational users might be able to afford and to justify protection only against voltage spikes, which is relatively cheap with "surge protectors" costing upward of $25. Other users may want to guard against both surges and electrical noise, usually requiring a combination of surge protection and line "isolation" in devices costing from $60 to $200.

On the other hand, protecting against short-duration power interruptions and brownouts using standby power supplies can cost from $250 to $1200 for small personal computers and many thousands for large-scale professional systems. Business users with critical applications may have to spend considerable sums to achieve multi-purpose protection against numerous disturbances. Yet, those expenditures may be justified by eliminating equipment damage and losses of vital data.

The number of available power-conditioning devices is staggering. At the low end of the price scale are inexpensive in-line surge suppressors and noise filters that guard against sudden increases in line voltage and against electrical noise that might be imposed on lines by appliance motors and other devices. Effective for mild disturbances on residential and commercial power lines, they do not safeguard equipment or data from outages, and most give limited protection against severe surges or the extreme noise typical of industrial facilities.

Heavy duty devices are available at added cost, providing improved protection against severe spikes and surges while eliminating potential electrical interactions between devices plugged into the individual sockets. Actually, if you can afford one, such heavy duty suppressors and isolators are preferable to the inexpensive home units. If you use your computer strictly for entertainment, an "industrial strength" isolator and suppressor will give you a definite edge.

For those with the money to spend, standby power supplies and uninterruptible power supplies are by far the best. Standby supplies are available in sizes from about 200 watts to megawatts and at prices from about $300 to many thousands of dollars. However, the average home or small-business user probably can get by with a 200-watt unit for a personal computer or something between 500 and 1250 watts fo a professional or business system. The advantage to these power supplies is that they provide automatic switch-over to temporary battery backup power during an outage or severe low-voltage condition. Furthermore, they typically include surge suppression and noise filtration with the standby power.

True uninterruptible power supplies, known as UPS units, differ in that they power the computer equipment continuously from batteries and charge the batteries while the incoming line is active. When line power is interrupted, batteries continue to output without any switchover. Like the standby units, these are available at many prices and in many sizes. However, a UPS unit of a given power rating typically costs more than a switching reserve supply of the same rating.

The system starts showing a few minor problems, but they quickly multiply.

Wear and Tear

Physical wear affects the moving parts in printers, disk drives, tape transports, keyboards, and switches. Since the component used most often wears the fastest, input-oriented systems probably will have more wear on the keyboards while output-oriented systems will have more wear on the printer.

The effects are twofold, leading to gradual decline in performance or an abrupt failure. In the first, the system starts showing a few minor problems, but they quickly multiply. One key might not register every time, then another and another. Disk I/O errors you saw once a month become weekly, then daily, then hourly. Printouts get fuzzy and indistinct, especially when compared to ones done months earlier.

Or there can be a sudden failure without warning. A printer abruptly stops feeding ribbon or paper; a disk drive spins the disk but can't seem to access any data; a power switch may not work to turn the equipment on or off.

Lubrication

The best protection, in fact, the only protection against wear is keeping the equipment clean, properly lubricated and operating at design temperatures.

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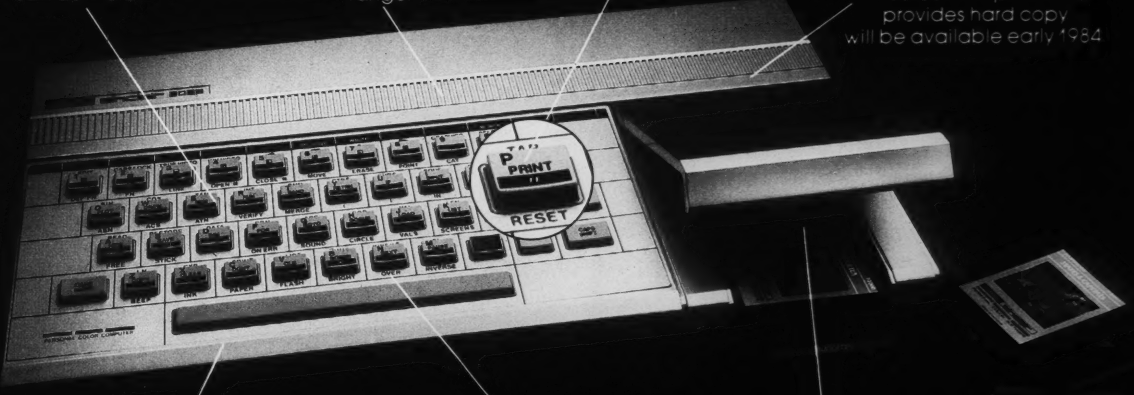

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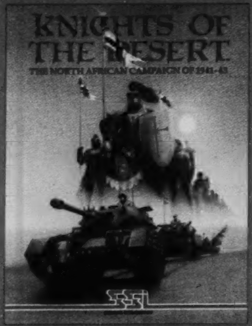

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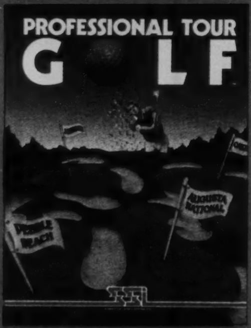

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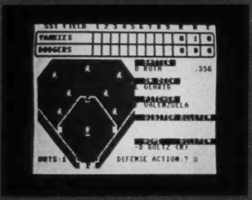

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CIRCLE 233 ON READER SERVICE CARD

There is no way to eliminate wear and stress on moving components, but you can minimize their effects.

Suitable lubrication is particularly important and must be provided in strict accordance with any schedules or procedures in equipment manuals. Failure to lubricate moving parts quickly runs up high repair bills; mechanical parts are much more expensive to fix than electronic ones. Excess lubrication isn't acceptable either, because it leaves residues that attact dirt, increase friction, and cause more wear. Watch out for parts that should not be lubricated, with special attention to the rails and components of the disk drives. Most maintenance manuals warn against lubricating the rails that support the read/write heads.

Be sure to use only those lubricants approved for the units or parts. There is no such thing as a universal oil, and one component like a letter-quality printer may need a dozen or more different lubricants. Of course, many high-grade lubricants are expensive, and stocking multiple types gets costly. Even service shops and technicians usually don't stock them all—a reason they don't volunteer often to clean and lubricate a machine.

If there is a wear- or stress-related failure, there is little to do except to replace the part or parts or to pay to have them replaced. However, you should be aware that it is hard to find a good source of repairs for mechanical components. Almost any hack can fix computer electronics by hit or miss replacements until the problem goes away. But mechanical units like letter-quality printers take some training and skill to repair, often requiring total machine realignment and adjustment for replacing a single small part. In fact, it is often necessary to send something like a printer back to the factory or to a regional service depot to get the job done right.

Retrospect

In this article, I have tried to give you some insight into what is really involved in caring for a small computer. Regrettably, a magazine article doesn't afford space to cover a subject like this in the detail it deserves. Whole books can be written just on cleaning procedures, and those are just one aspect of the total picture.

It is important to look for the obvious. Take care of dirt, excess heat, magnetic fields, static charges, power disturbances, and lubrication, and you have solved most of the problems. By doing some routine tasks, you improve the odds in favor of a long, happy relationship with your computer system. ☐

Buyer's Guide to microcomputer care and maintenance products

This is a partial list of companies providing useful products for the care and maintenance of microcomputers. It is not a complete list of all suppliers, and should be considered only a sampling. Users should contact these and similar companies for catalogs, product specifications and other information.

ALF Products, Inc., 1448 Estes, Denver, CO 80215. (303) 234-0871.
Penulticopy ($34.95)—high-speed high-reliability self-formatting copy program for duplicating and backing up Apple DOS disks. Not a nibble copier so will not work on copy-protected disks.

Advanced Micro Techniques, 1291 E. Hillside Blvd., Suite 209, Foster City, CA 94404. (415) 349-9336.
Dpatch ($195)—a disk-recovery utility program for CP/M systems incorporates direct disk and file alteration, recovery from input/output errors, recovery of erased disk files, and certification of disk surfaces.

Associated Research Enterprises, P.O. Box 22463, Denver, CO 80224. (303) 759-3880.
Watts Out ($5.95 ea.)—provides protection against static electricity.

Billings McEachern, Inc., 402 Lincoln Centre Dr., Foster City, CA 94404. (415) 570-5355.
GS-1 and GS-2 Power Line Monitors ($345 and $975)—plug-in monitors to identify power line disturbances such as surges, high and low voltages. GS-1 uses indicator lights for various types; GS-2 includes a paper-tape recorder that logs time and type.

Blat R&D Corporation, 8016 188th St. S.W., Edmonds, WA 98020. (206) 771-1408.
Badlim ($73)—disk surface certification program for CP/M systems. Locates and locks out bad sectors to prevent loss of data due to recording over sectors that can't be read back.

BT Enterprises, 10B Carlough Rd., Bohemia, NY 11716. (800) 645-1165.
The Voltector ($68.50)—Plug-in power conditioner provides surge protection and filtering.

Cab-Tek, Inc., Riverside St. Nashua, NH 03062. (800) 343-4311.
Micro Power Bench ($79)—Built-in circuit breaker protects system. Choice of oak or walnut; compatible with Apple, IBM, TRS-80, and others.

Computer Case Company, 5650 Indian Mound Ct., Columbus, OH 43213. (614) 868-9464.
Heavy duty carrying cases for small computers and peripherals. Cases provide protection for delicate equipment while being transported. Various models are available at differing prices in accordance with equipment type and size.

Control Technology, Inc., 8200 No. Classen Blvd., Suite 101, Oklahoma City, OK 73114.
Reserve power supplies for small computers such as the Apple II and IBM PC. The older APS-5 ($389.95) is being replaced by a new, improved unit. These products are specific to individual computers, connecting between the internal power supply and motherboard. They offer some of the longest "hold-up" times of any units available for backup against power failures.

Cover Craft Corp., P.O. Box 555, Amherst, NH 03031. (603) 889-6811.
Dust Covers ($8.95-$15.95))—protects hardware from dust, grime, spills and static electricity.

Digital Marketing, 2670 Cherry Lane, Walnut Creek, CA 94596. (415) 938-2880.
File Fix ($100)—general purpose CP/M disk utility system

Care of Your Computer, continued...

including erased file recovery, relocation of files between user areas, forged linkages to access programs in other user areas, and a number of other useful utilities.

Discwasher, 1407 North Providence Rd.,
Columbia, MO 65205. (314) 449-0941.
Discwasher ($16.50)—Cassette Drive Care Set is a total maintenance package for cassette based systems; the Disk Drive Cleaner is a dry cleaner for single or double sided drives.

Dymarc Industries, Inc., 7133 Rutherford Rd., Baltimore, MD 21207. (301) 298-3130.
Clipstrip and Clipper—low cost in-line power conditioners for surge suppression.

Electronic Protection Devices, 5 Central Ave.,
Waltham, MA 02154. (617) 891-6602.
The Peach ($97.50)—a clamping device which protects against surges, glitches, and spikes, and filters out noise.

Electronic Specialists, 171 South Main St., Natick, MA 01760. (617) 655-1532.
Various power conditioners across a wide range of prices. Products include surge suppressors and noise isolators for light-duty applications and heavy duty versions for critical applicatons and severe disturbances.

Fiberbilt/Ikelheimer-Ernst, Inc., 601 West 26th St., New York, NY 10001. (212) 675-5820.
Light and heavy duty cases for protecting equipment while transporting small computers and peripherals. Prices vary according to the brands of equipment, number of components housed, etc.

Gould, Inc., 2727 Kurtz St., San Diego, CA 92110. (714) 291-4211.
Deltec uninterruptible power supplies. Numerous types of true UPS units, voltage regulators, and similar units for virtually any size business or professional system. Prices range upward from several hundred dollars depending on the outputs and holdup times needed.

Hutton Industries, Inc., P.O. Box 1413, Tacoma, WA 98401.
QWK Cover ($12.95)—keyboard cover for the Apple II. Offers good dust protection and effective spill protection while system is not in use.

Inmac, 2465 Augustine Dr., Santa Clara, CA 95051. (408) 727-1970.
Extensive line of computer and system care products including keyboard covers, cleaning kits, surge protectors, line monitors, etc. The Inmac catalog is a "must have" item for all computer owners and users.

Kalglo Electronics Co., Colony Dr. Ind. Park, 6584 Ruch Rd., Bethlehem, PA 18017. (800) 523-9685.
Spike-Spikers (Range from $34.95-$79.95)—Surge suppressor protects sensitive electronic equipment. Prevents software glitches, unexplained memory loss, and equipment damage.

Kensington Microware, Ltd., 300 East 54th St., New York, NY 10022. (212) 490-7691.
System Saver ($89.95)—cooling fan with in-line power conditioning (surge suppression) for Apple II computers. Particulary useful for protecting against excessive heat buildups in heavily equipped Apple computers.

Ladco Development Co., P.O. Box 464, Olean, NY 14760.
Ramlock ($435 to $945)—reserve power supplies (switching type) available in several sizes and prices for different system requirements and current drains.

Last Electronics, Inc., P.O. Box 1300, San Andreas, CA 95249. (209) 754-1800.
Plexa-Lok ($19.95, approximate)—transparent keyboard shields for several popular computers. Units slip over keyboards to provide dust reduction and spill protection. Ventilation allows use for tamper protection while computer is operating.

Mark Four Imports, P.O. Box A, San Gabriel, CA 91776. (213) 287-9945.
Cool-Mark II ($34.95)—internally mounted cooling fan for the Apple II. Provides forced-air cooling in applications where external fans may be unusable or undesirable.

Masterworks Software, Inc., 1823 Lomita Blvd., Lomita, CA 90717. (213) 539-7486.
MasterDisk and *MasterDos* ($29.95 ea)—disk and disk operating system utilities for file and media care or maintenance.

National Field Sales, 2660 W. Chester Pike, Broomall, PA 19008. (215) 359-1004.
Stedi-Watt Jr.—Power conditioning equipment for medium-duty installations. Numerous models at various prices are available.

Nikrom Technical Products, 25 Prospect St., Leominster, MA 01453. (800) 835-2246.
Master Diagnostics + Plus ($75)—combination of diagnostic software for the Apple II, a disk drive cleaning kit, and other cleaning products. Software provides a thorough shakedown of the computer system components.

Omni Communication, Inc., R.D. 3, Box 200, Jackson, NJ 08527.
Blitz Bug ($24.95)—plug-in line conditioner claiming to eliminate high-voltage spikes and provide protection from damaging electrical transients.

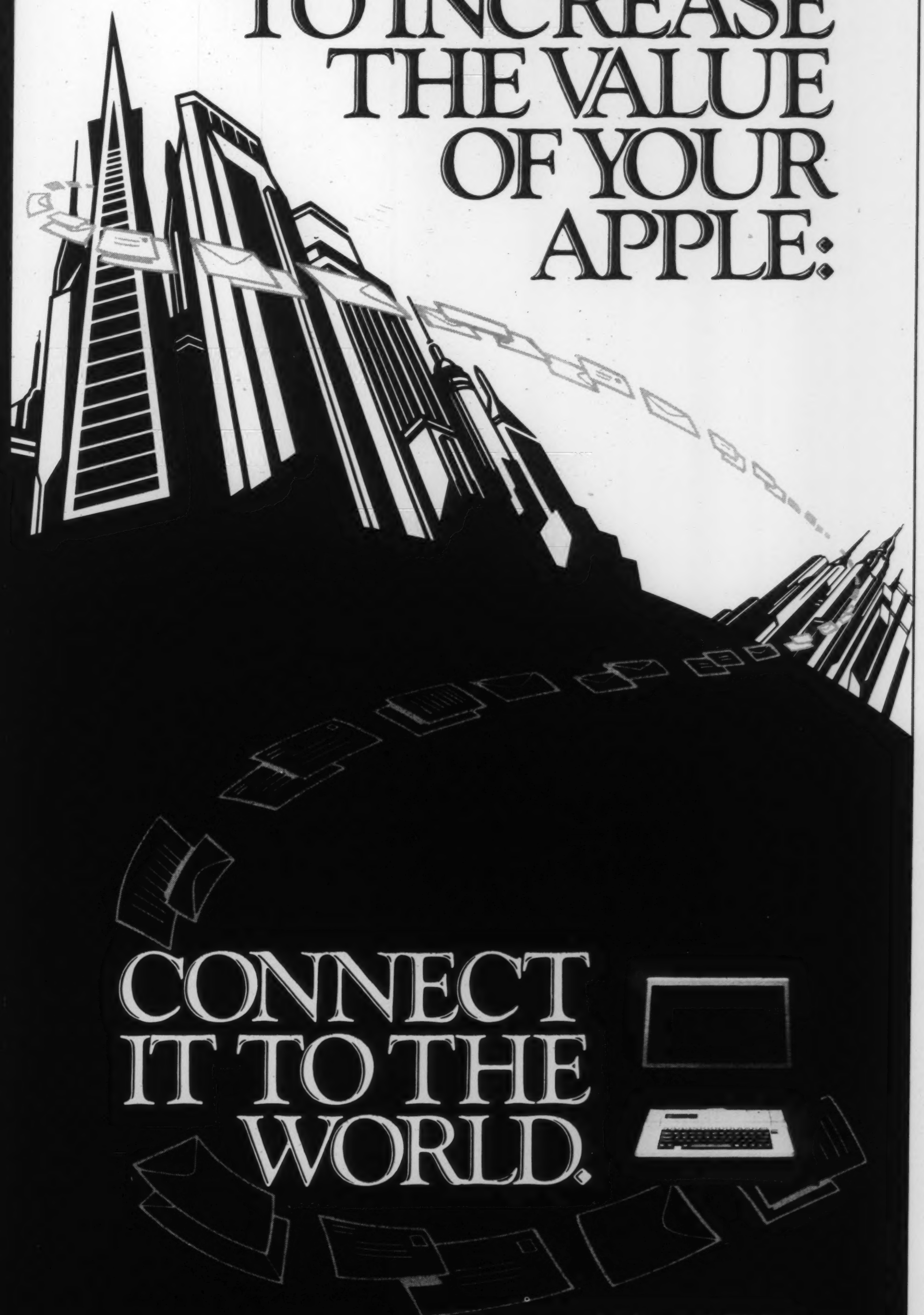
Panamax, 150 Mitchell Blvd., San Rafael, CA 94903. (415) 472-5547.
Power conditioners (fused surge suppressors) for small computer installations. Several models are available for different power requirements and at different prices.

Perfect Data Corporation, 9174 Deering Ave.,
Chatsworth, CA 91311. (213) 998-2400.
Extensive line of Perfect Data Computer Care Products at economical prices. Offerings include video cleaning kits, anti-static kits, disk drive cleaning kits, and complete micro-computer care kits.

Prometheus Products, Inc., 45277 Fremont Blvd.,
Fremont, CA 94538. (415) 490-2370.
APPLEsurance II—A combination diagnostic and system assurance tool plus a compatible disk controller for Apple II. Diagnostic routines check system hardware. Disk controller card with automatic diagnostic is $125. Disk based software is $50.

R.H. Electronics, Inc., 566 Irelan, P.O. Bin CC, Buellton, CA 93427. (805) 688-2047.
Super Fan II ($69)—cooling fan for the Apple II; a higher-priced version ($125) includes power-line conditioning (surge and noise protection). Guardian Angel ($595)—standby in-line power supply for the Apple II and other small computers for several minutes of holdup power in the event of a power failure, low-voltage condition, etc.

THE BEST WAY TO INCREASE THE VALUE OF YOUR APPLE:



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Care of Your Computer, continued...

RKS Industries, Inc., 4865 Scotts Valley Dr., Scotts Valley, CA 95066. (408) 438-5760.
Surge Sentry ($89.50 to $132)—power surge protection for computers and peripherals.

Saft America, Portable Battery Division, 931 No. Vandalia St., St. Paul, MN 55114. (612) 645-8531.
Switching-type standby power supplies in 200-watt ($489) and 400-watt ($689) outputs.

SOLA, 1717 Busse Rd., Elk Grove Village, IL 60007. (312) 439-2800.
True uninterruptible power supplies in various sizes for almost any type of popular business or professional microcomputer installation.

Sun Research, Inc., Box 210, New Durham, NH 03855. (603) 859-7110.
Mayday standby power supplies. An extensive line of sizes (up to 600 watts) and prices in square-wave and sine-wave switching supplies for protection against power failures.

SuperSoft, Inc., P.O. Box 1628, Champaign, IL 61820. (217) 359-2112.
Diagnostics II ($125) is a general-purpose system diagnostic software package for CP/M systems, providing tests of the CPU, memory, disks, and peripherals. *Disk Doctor* ($100) is a disk error recovery system for restoring damaged and erased files but doesn't work with double-sided drives. *Disk Edit* ($100) is a general purpose disk utility for accessing and changing information on the media.

Sympathetic Software, Inc., 9531 Telhan Dr., Huntington Beach, CA 92646.
Disk Prep ($25)—an Apple II program to test and prepare disk surfaces prior to use, thereby locking out bad sectors and surface flaws.

Texwipe, 51 Prospect Pl., Hillsdale, NJ 07642. (201) 327-9100.
A wide assortment of cleaning and care products for nearly any budget and application. Their catalog is a worthwhile reference for all computer installations.

3M Company, 3M Center, St. Paul, MN 55144. (612) 733-1110.
Static control mats in various sizes and at various prices. Also provides a portable anti-static field service kit for static protection while working on equipment.

Tovatech, 1903 Fordham Way, Mountain View, CA 94040. (415) 968-0392.
Ventop ($45)—slotted replacement cover for the Apple II, replacing factory supplied cover to provide convection cooling of the chassis, particularly over the expansion connectors where heat buildups result from plugging in extra boards.

Trace Systems, 1928 Old Middlefield Way, Mountain View, CA 94043. (800) 24TRACE.
Station II ($129)—Protects Apple from power surges and power switch failure. It is also a power switch with a surge suppressor built in. Optional fan.

XPS, Inc., 323 York Rd., Carlisle, PA. (800) 233-9512.
Apple-Cillin II ($49.95)—collection of extensive diagnostic routines for Apple II systems. It includes tests of motherboard and add-on memory, the CPU, the disk drives, the keyboard, the display, and other components.

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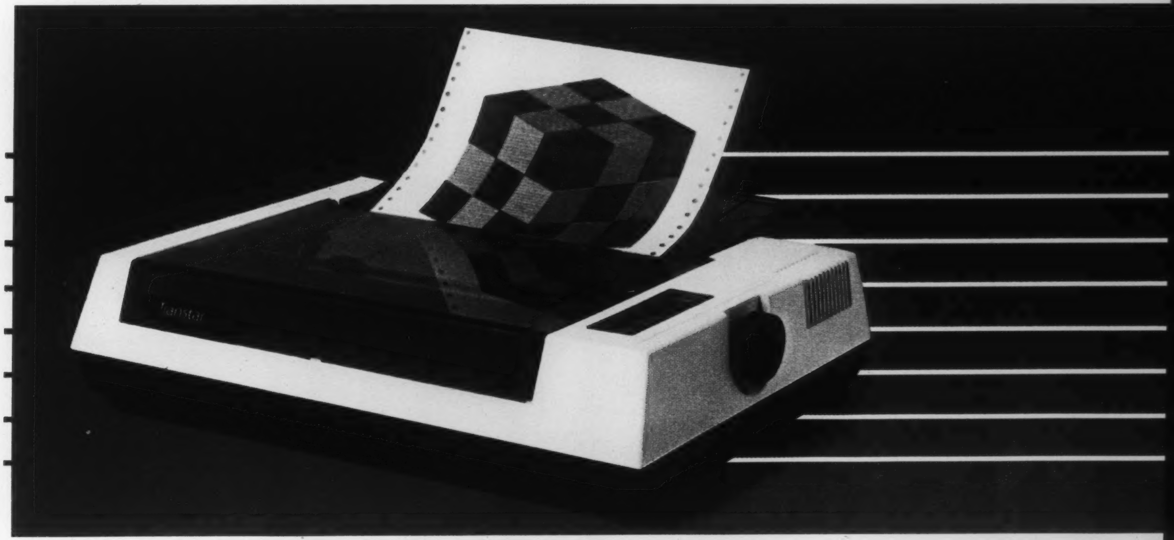

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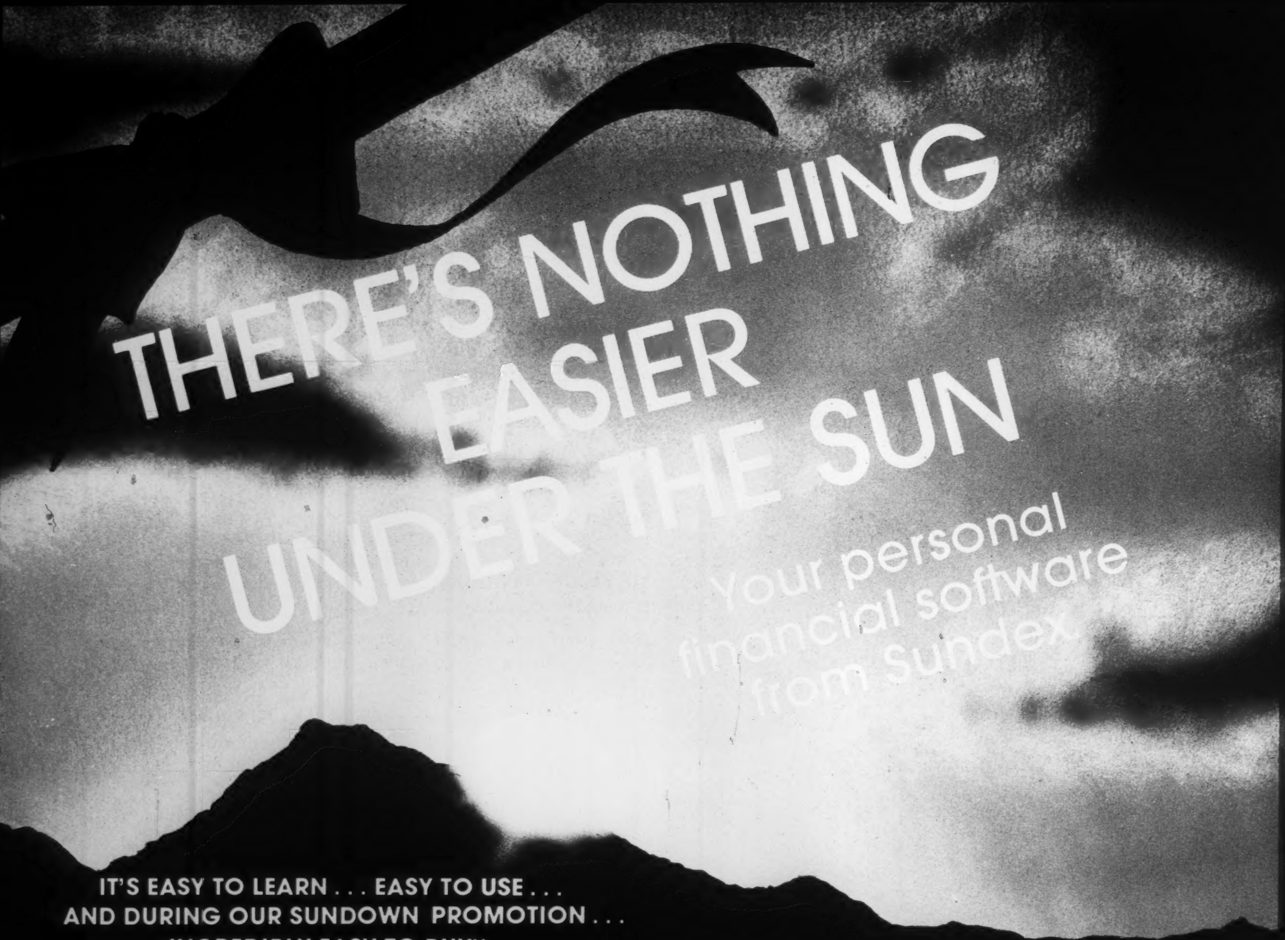
CIRCLE 236 ON READER SERVICE CARD



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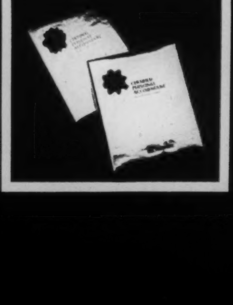

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CIRCLE 241 ON READER SERVICE CARD

Floppy Disk Handling and Storage

David H. Ahl

If you have ever wiped out a floppy disk but not known the reason why, you have lots of company. A few months ago, after a spate of unfortunate disk disasters on two trips, we decided to look into the problem in depth. Could it be the airport weapons detectors? Were the disks deteriorating from age? Was it high temperature or humidity?

We wrote to ten manufacturers of floppy disks with a list of questions about "unusual" situations and also asked their advice on everyday disk handling. Only two manufacturers replied—Maxell and Verbatim—which perhaps is an indication that most manufacturers would rather sell you new disks than tell you how to keep the old ones from wearing out.

We'd like to thank Ted Ozawa and David Berry of Maxell and Erica Baccus of Verbatim for their help in putting together this article.

Disk Surface. On a single sided disk, the recording surface is on the lower side, i.e., opposite from the label. Thus removing it from the drive and laying it on a dusty desk is not recommended. Just about anything is large enough to interrupt the contact between the head and disk surface and result in a loss of data (see Figure 1). When the disk is removed from the drive it should always be stored in its protective envelope. Don't ever touch the surface of the disk; fingerprints are bad news.

Disk Cleaning. In general, it can't be done. Moreover, many solvents such as alcohol, thinner, and freon will remove the oxide from the disk surface. Keep your heads clean with one of the commercial cleaning kits, and your disks should remain clean.

Bending and Squeezing. Don't bend or fold a disk. Placing heavy objects on disks or jamming them together in a storage box will crush the jacket edges and cause them to spin unevenly, thus making reading and writing erratic.

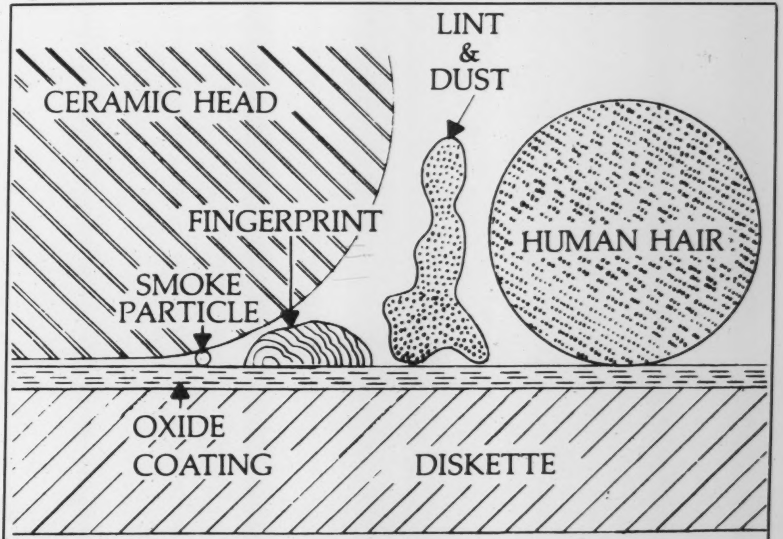
Labels. If possible, the label should be written on before placing it on the disk. If, however, you must write on a label that has already been applied, use only a felt or nylon tip pen, never a ballpoint pen or pencil. Never use an eraser on a disk label, and use peelable labels which don't leave a residue. Peel off the old label when putting a new one on; don't apply labels in layers.

Jacket Care. Do not use a paper clip, rubber band, or any other fastener on a disk jacket or envelope. Instead, put the disk and protective envelope in a plastic or paper envelope and fasten that to whatever you must.

Disk Storage. Disks not being used should be stored upright in a dustproof container. If they are stored on top of one another, there is a tendency for the jackets to become warped. Unlike cassette tapes, if a disk is in long-term storage, it is not necessary to give it a spin every once in a while.

Shelf Life. As long as a disk is stored in the proper temperature range (50°F to 125°F) and humidity range (8% to 80%), the shelf life is 30 years (according to Verbatim) or "practically forever" (according to Maxell). As we all know, in personal computing, 30 years is practically

Figure 1.



forever. Magnetic tapes are susceptible to the oxide flaking off after a period of time; disks do not have this problem, and the magnetic life is virtually infinite.

Service Life. In normal use with a drive that is in good repair, a disk will provide three to ten million passes. A data disk that is constantly being written and erased will have considerably more head contact than, say a game disk that is just loaded once per session. Nevertheless, it is difficult to conceive of a disk being subject to anything like three million passes.

Operating Environment. Like the storage environment, the operating temperature range should be 50°F to 125°F with relative humidity between 20% and 80%. Obviously, excessive heat or sunlight are to be avoided.

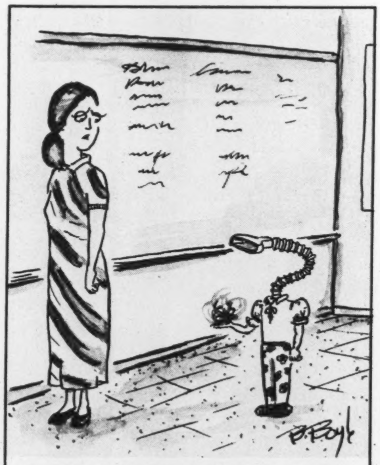
Magnetic Fields. Since the data on a disk are stored in minute magnetic regions, the information can be altered or completely eliminated if the disk is exposed to a magnetic field. Permanent magnets such as those on typing guides or those used to hold memos on the side of a file cabinet should be kept at least one foot away from disks. Permanent magnets are also found in loudspeakers. Although it is not likely that a speaker in a housing will cause problems with a disk, it is best not to tempt fate by putting disks on top of a speaker.

However, any transformer or motor generates a magnetic field. Very small motors such as those used in disk drives, cassette recorders, or printers are not a problem, however, larger motors such as those found in air conditioners can be if a disk is too close. Also, disks should be kept away from external power supply transformers such as those used with Atari computers. Likewise, disks should be kept away from the ballasts in fluorescent desk lights and the transformers in the bases of high intensity lamps.

Airport Metal Detectors. The walk through weapons detectors used in airports generate a slight magnetic field (about 5 oersteds) but not nearly enough to affect a disk (50 or more oersteds). The detectors used to examine carry-on baggage are X-ray detectors and have no detectable magnetic effects.

Sending a Disk in the Mail. An old wives tale has it that disks should be wrapped in foil when they are mailed. Not so; aluminum foil provides no magnetic protection and it isn't necessary anyway. Much more important is to keep the disk from being bent or crushed. For this, a stiff piece of cardboard or hard foam plastic is best. Commercial mailers known as Floppy Armor provide excellent protection.

If you follow these dos and don'ts, and clean your drives regularly, your disks should give you a lifetime of service. END



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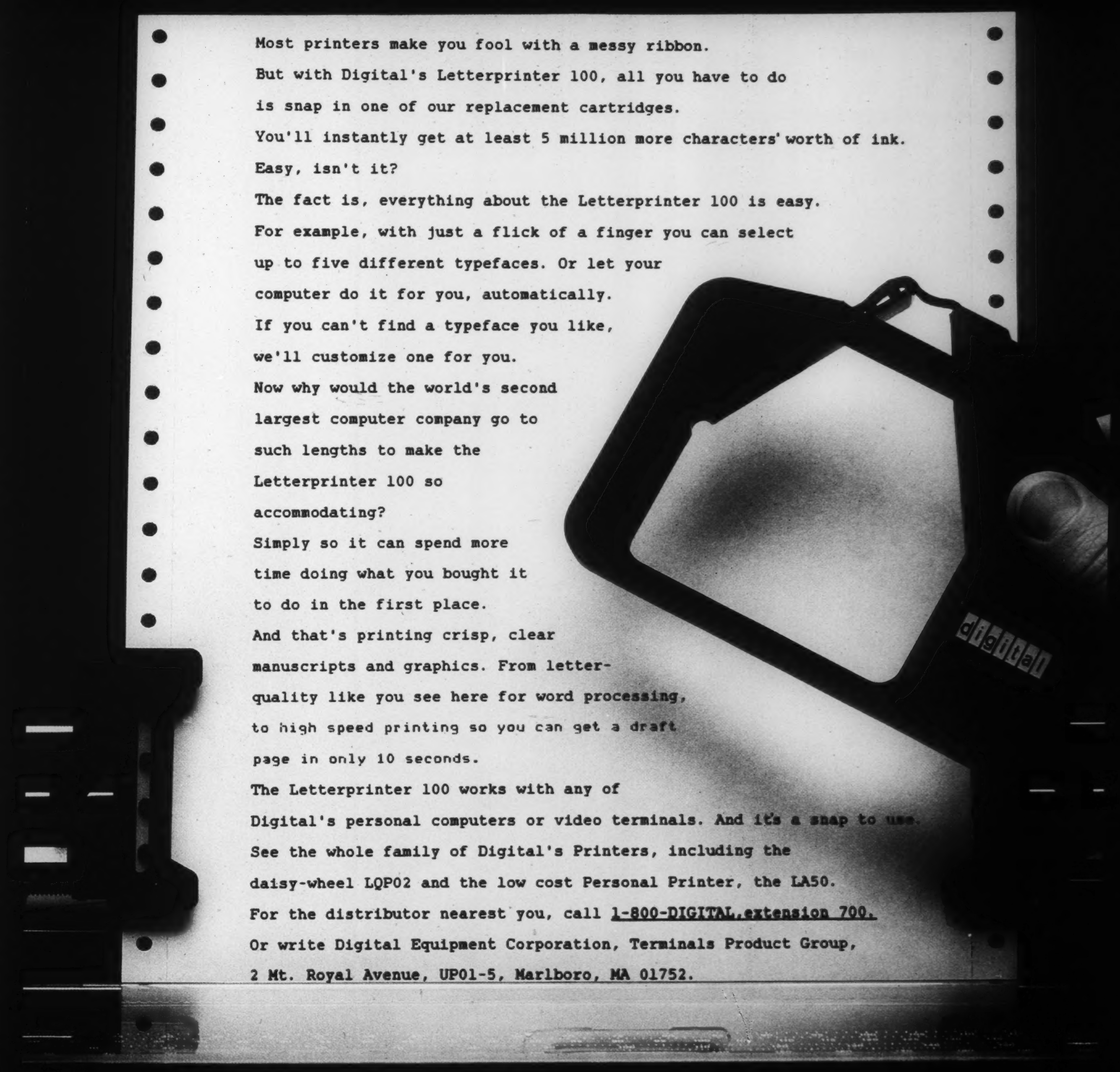

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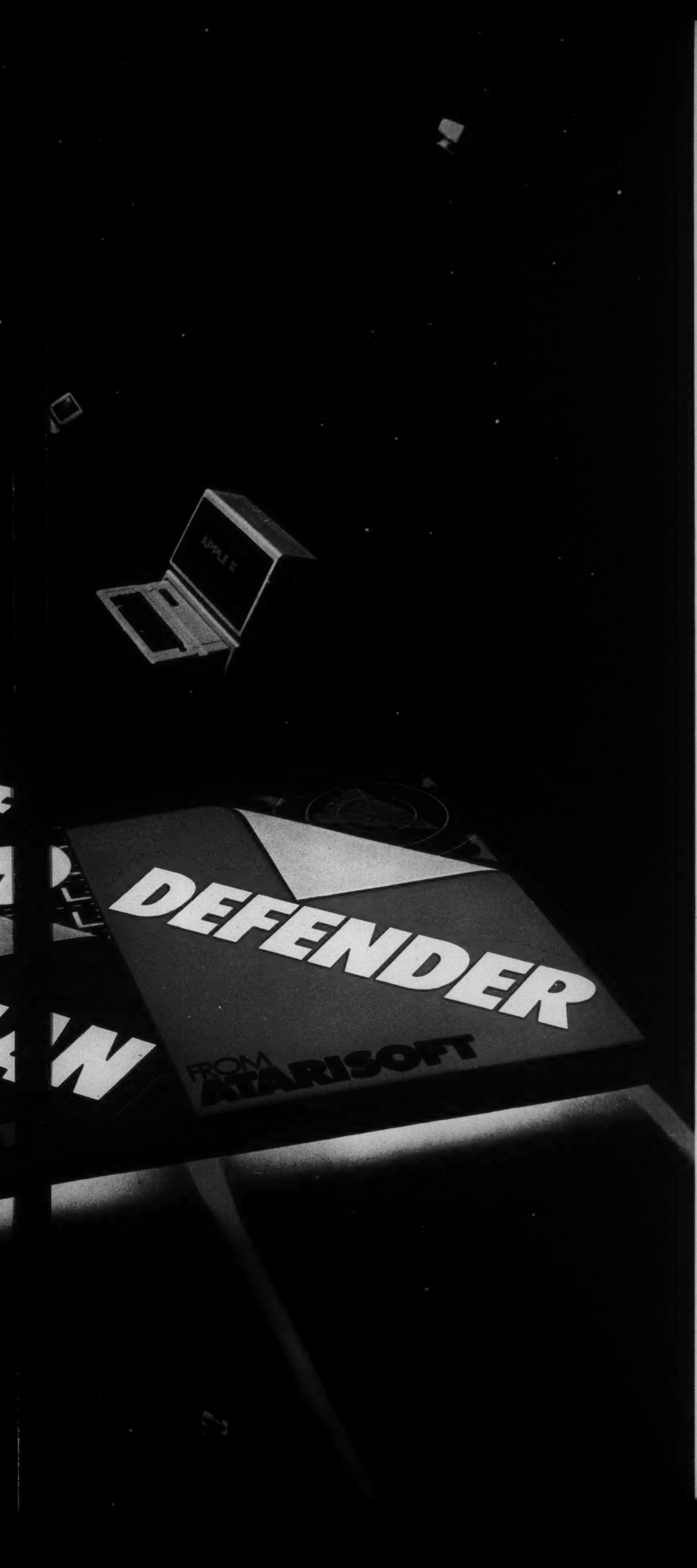

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A Discussion of Floppy Disk Head Cleaning Kits

Keep It Clean

Lew Whitaker

A new, very popular accessory has entered the word processing, personal computer and small business computer market—the floppy disk head cleaning kit. It is designed to enable the user to maintain (clean) the read/write heads on a floppy disk drive without having to call a qualified (and expensive) field engineer.

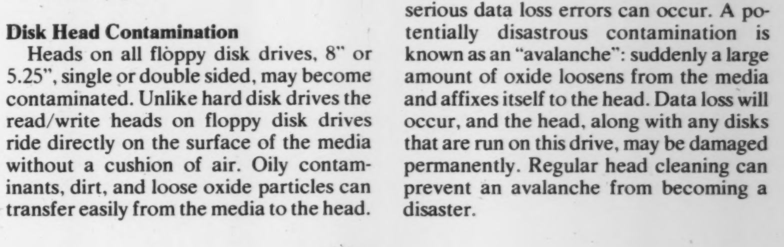
At first, manufacturers offered the kits directly. Later, several computer drive and media manufacturers tested and offerred the kits as an OEM item. Now they are also offered in most retail computer stores and sold through direct mail catalogs.

Although most types of head cleaning kits function similarly—you insert a cleaning disk in the drive and it rotates under the read/write head for a set period—materials and concepts vary. These variations, though subtle, affect both the cleaning ability and the life of the head and the drive.

With the proliferation of small disk oriented computers, many non-technical users wonder which maintenance techniques and products are best. There isn't much information on the effectiveness of disk head cleaning or on the merits of the various types of kits available, so users have often purchased kits on a subjective or a non-technical basis. Here are some answers to questions users ask about using a self-maintenance tool like a disk drive head cleaning kit.

Disk Head Contamination

Heads on all floppy disk drives, 8" or 5.25", single or double sided, may become contaminated. Unlike hard disk drives the read/write heads on floppy disk drives ride directly on the surface of the media without a cushion of air. Oily contaminants, dirt, and loose oxide particles can transfer easily from the media to the head. If contamination builds up so that the recording area of the read/write head does not meet the recorded media surface, serious data loss errors can occur. A potentially disastrous contamination is known as an "avalanche": suddenly a large amount of oxide loosens from the media and affixes itself to the head. Data loss will occur, and the head, along with any disks that are run on this drive, may be damaged permanently. Regular head cleaning can prevent an avalanche from becoming a disaster.



Lew Whitaker, c/o P. Marie Martin, Susan Croft Associates Public Relations/Conference Management, 8929 S. Sepulveda Blvd., Suite 414, Los Angeles, CA 90045.

Cleaning Kit Comparison

Name	Cleaning Concept	Drive Head Compatible	Drive Sector Compatible	Recommended Clean Frequency	Recommended Clean Cycle	Friction Drag[1] Head/Media
Allsop 3	Wet/Dry	All	Soft/Hard	Weekly	30 seconds	1.6
BASF	Dry	Single	Soft	None	60 seconds	3.6
Compu-Clean[3]	Dry	Either	Soft	8 hours	30 seconds	3.2
Discwasher	Dry	Single	Soft	8-10 hours	30 seconds	n/a
Headmaster	Wet/Dry	All	Soft/Hard	10 hours	30 seconds	n/a
Inmac	Wet/Dry	All	Soft/Hard	Weekly	30 seconds	n/a
Nortronics	Wet/Dry	All	Soft/Hard	10 hours	30 seconds	n/a
Perfect Data	Wet/Dry	All	Soft/Hard	40 hours	30 seconds	1.6
3M	Wet/Dry	All	Soft	40 hours	30 seconds	1.6
Vari-clean	Wet/Dry	All	Soft/Hard	Weekly	30 seconds	n/a
Verbatim	Wet	All	Soft/Hard	40 hours	60 seconds	1.6

[1] Frictional drag is the amount of friction caused by the head rubbing on the media. Too much friction between the two and the heads and the media could be damaged or worn prematurely.

[2] The motor torque is the amount of resistance encountered when the motor is in operation and is rotating the media inside the jacket. Too much torque (measured in inch/ounces) could cause premature or excess wear on the motor. The ANSI spec for torque reads "not to exceed 10 inch/ounces."

[3] Compu-Clean, as of press time, is marketed only in Europe.

Allsop, Inc.
P.O. Box 23
Bellingham, WA 98227

BASF Systems Corp.
Crosby Drive
Bedford, MA 01730

Discwasher
1407 North Providence Rd.
Columbia, MO 65205

Inmac
2465 Augustine Dr.
Santa Clara, CA 95051

Nortronics Company Inc.
8101 Tenth Avenue North
Minneapolis, MN 55427

Perfect Data Corp.
9174 Deering Ave.
Chatsworth, CA 91311

Quill Corp. (Vari-Clean)
100 S. Schelter Rd.
Lincolnshire, IL 60069

SSK Enterprises (Headmaster)
2488 Townsgate Rd.
Westlake Village, CA 91631

3M Company
3M Center
St. Paul, MN 55144

Verbatim
323 Soquel Way
Sunnyvale, CA 94086

Computers are installed in offices, factories, industrial plants, warehouses, and homes, without particular concern for the operating environment. This expanding population of small computers greatly increases the need for a preventive maintenance program.

Frequency Of Cleaning

Like the incidence of head contamination, head cleaning frequency depends on many factors. The type of media used and the operating environment affect the necessity and frequency of cleaning. Most computer manufacturers have adopted a neutral position on head cleaning frequency, relying on the media or the disk drive manufacturers to establish a standard. It appears that a safe standard is once a week, except under extremely adverse environmental conditions or when persistent disk drive errors occur. Under these conditions, the recommended frequency for cleaning is once per eight hours of drive operation.

Effectiveness

Tests have shown that head cleaning kits are particularly effective on read/write heads with light to moderate amounts of contamination build-up. After contamination has had the opportunity to adhere solidly to the surface of the recording area, however, a talented and hardworking field engineer must remove the contamination. Fortunately, this degree of disastrous head contamination is very rare. Therefore, commercially available cleaning kits are effective against most types of contamination.

Cleaning Kits

Four different types of cleaning kits are offered in the United States. A fifth type is sold in Japan, but for reasons to be detailed later, it isn't available in this country. Cleaning kits can be divided into three basic categories depending on the cleaning concept used: cleaners using a wet/dry concept; cleaners using a dry only concept; and cleaners using a wet only concept.

Wet/Dry Cleaners

Two companies, Perfect Data Corporation, and 3M offer the wet/dry process.

Perfect Data has patented a proprietary wet/dry cleaning process for disk drive heads. The Perfect Data cleaning concept uses a special cleaning disk inside a standard size vinyl jacket. The jacket, however, has a wide, half-moon shape cutout in place of normal head access slot. Inside the jacket is a disk of nonwoven, spun

Torque On Motor[2]	Cost Per Kit	Cost Per Cleaning
7-8	$37.00	$1.42
15-20	$45/3	$1.25
12-15	$75.00	$1.25
n/a	$24.95	$1.00
n/a	$24.95	$1.28
n/a	$45.00	$0.75
n/a	$32.50	$0.13
7-8	$30.00	$1.10
7-8	$30.00	$1.10
n/a	$28.00	$0.70
8-11	$12.50 (starter)	$2.00

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Computer Maintenance
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NORTRONICS
FLOPPY DISK HEAD CLEANING SYSTEM-5¼"

A typical wet/dry head cleaning kit consists of nonwoven fabric cleaning disks, a disk jacket, cleaning solution, and instructions.

bonded, nonabrasive polyester. When you clean the heads you put a small amount (2 ml) of the Perfect Data special cleaning solution in the cutout area and place the disk in the drive.

Since only one-third of the cleaning disk has been moistened, the disk is cleaned by having the alternating wet and dry portions of the disk pass under the read/write head(s). A useful feature is that you can use the same disk to clean either single or double sided disks. For a double sided drive, the user removes a tab in the jacket. The Perfect Data cleaning disks are available for 5" and 8" drives.

3M produces a product similar to the Perfect Data kit. In fact, 3M manufactures their cleaning kit under license from Perfect Data. The physical dimensions, jacket material, and solution are basically identical, although there are some minor differences in the composition of the cleaning material. Like Perfect Data, 3M produces kits for 5.25" and 8" drives. You can also use these kits on either single or double sided drives.

3M also manufactures cleaning kits on an OEM basis for several other companies. For example, the Allsop 3 kit is made by 3M. Several of the large office supply and EDP supply houses also offer kits which appear to be made by 3M. Two of these, Vari-Clean from Quill Corp. and the kit from Inmac, like supermarket private labels, offer a somewhat better value than the name brands.

Nortronics also offers a wet/dry system which, theoretically, is more effective than the Perfect Data/3M system. Unlike the other systems, the Nortronics comes with a set of program listings for the Apple, Atari, TRS-80, IBM PC, TI 99/4A, Commodore 64, and CP/M systems. The program, once loaded into your computer, positions the head over one of four cleaning bands on the cleaning diskette and spins the disk for 30 seconds. As with the other systems, Nortronics recommends spraying one-third of the cleaning disk with the cleaning solution included with the kit. The kit contains eight disposable cleaning disks, each good for 32 cleanings; this is in contrast to the 8 to 12 cleanings from a one-track cleaning disk. At the suggested retail price of $32.50, this means that each cleaning costs under 13 cents, clearly a best buy.

Another wet/dry system is that manufactured by SSK Enterprises and sold under the brand name Headmaster. This differs from the other systems in that each cleaning diskette has four large oval openings around the disk into which the cleaning fluid is applied. So instead of having one-third of the disk wet and two-thirds dry, the Headmaster system wets four areas comprising one-half of the disk and follows each one with a dry area.

Dry Cleaners

BASF uses a standard vinyl disk jacket including the narrow cutout for the head access. Inside the jacket, a sheet of very thin, nonwoven polyester cleaning material is welded to the oxide side of a standard disk. To operate, you insert the cleaning disk into the drive to be cleaned. The door is shut (head is accessed) and the cleaning disk is allowed to rotate for 60 seconds. Since you can use this disk only on single sided drives, you must take care to ensure that the proper side of the disk faces the read/write head.

Compu-Clean is nearly identical to the BASF disk in appearance and concept. The Compu-Clean uses a blue or a gray vinyl jacket instead of the standard black. Instead of a standard disk the cleaning material is welded onto clear mylar. This does not alter the operation of the cleaning disk however. With the Compu-Clean product, you can clean dual sided drives. But the head configuration must be specified. The kits are not interchangeable.

Another dry system is that made by Discwasher, the record care folks. Like the Nortronics system, this comes with program listings for the Apple, IBM PC, Vic-20, and CP/M. The instructions tell us, "if a program is not listed for your system, translate one of the listed programs." This is easier said than done as all of the programs make extensive use of POKE statements which do not easily translate across systems. Like the other dry systems, this is a single-sided disc which must be turned over for double-sided drives.

Wet Cleaners

The latest entry into the market for disk drive head cleaning products is Verbatim, the Sunnyvale, CA, media manufacturer. Verbatim offers a disposable cleaning disk and a reusable Lexan jacket. The disposable cleaning disks, which are pre-saturated with a fluorocarbon and isopropyl alcohol solution, come individually sealed in a metallic pouch.

You remove the pre-saturated disk from the sealed pouch, place it in the Lexan jacket and insert the jacket into the drive. If the drive to be cleaned has dual heads, you remove the replaceable label from

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Keep It Clean, continued...

the head access opening on the Lexan jacket. At the end of the 30 to 60 second cleaning cycle, you remove the cleaning disk from the jacket and discard it. You need a fresh disk for each drive to be cleaned.

In addition to the products listed, another type of cleaner, formerly marketed by BASF in Europe (and briefly in the U.S.), is sold in Japan. It looks like a standard disk, but has a much coarser and more abrasive oxide formulation. Normally called a lapping tape, it is used in the manufacture of heads to perform the final head contouring. It can be an effective cleaner, especially against a heavy build-up of oxide like that found on heads after avalanche conditions. Because of its abrasive qualities, however, you must take extreme care not to remove a measurable portion of the head. Because of this potential hazard, the product has not been introduced in this country.

> ***Conscientious use of head cleaning kits can have a significant positive effect on computer operation.***

Conclusion

Conscientious use of head cleaning kits can have a significant positive effect on computer operation. The benefits of disk drive head cleaning have been documented by disk drive manufacturers' testing and through many endorsements by users.

Many drive manufacturers now endorse the concept of disk drive head cleaning. Until recently, however, computer and drive manufacturers took rather strong positions that head cleaning was unnecessary, could damage heads, and in certain cases could void the system warranty. Even today, no drive or computer manufacturer wholly endorses all head cleaning devices. A few still maintain that head cleaning does little good, and most specify which kits can be used on their particular systems without voiding the warranty.

Some companies that endorse (and/or market) head cleaning products are Shugart, Burroughs, Xerox, Data General, Philips, Radio Shack, Hewlett-Packard, Univac, CADO, CPT and Wang. For the average user of disk oriented small business equipment, word processing equipment, or personal computers, purchasing and using a head cleaning kit is now a safe, practical and recommended procedure.

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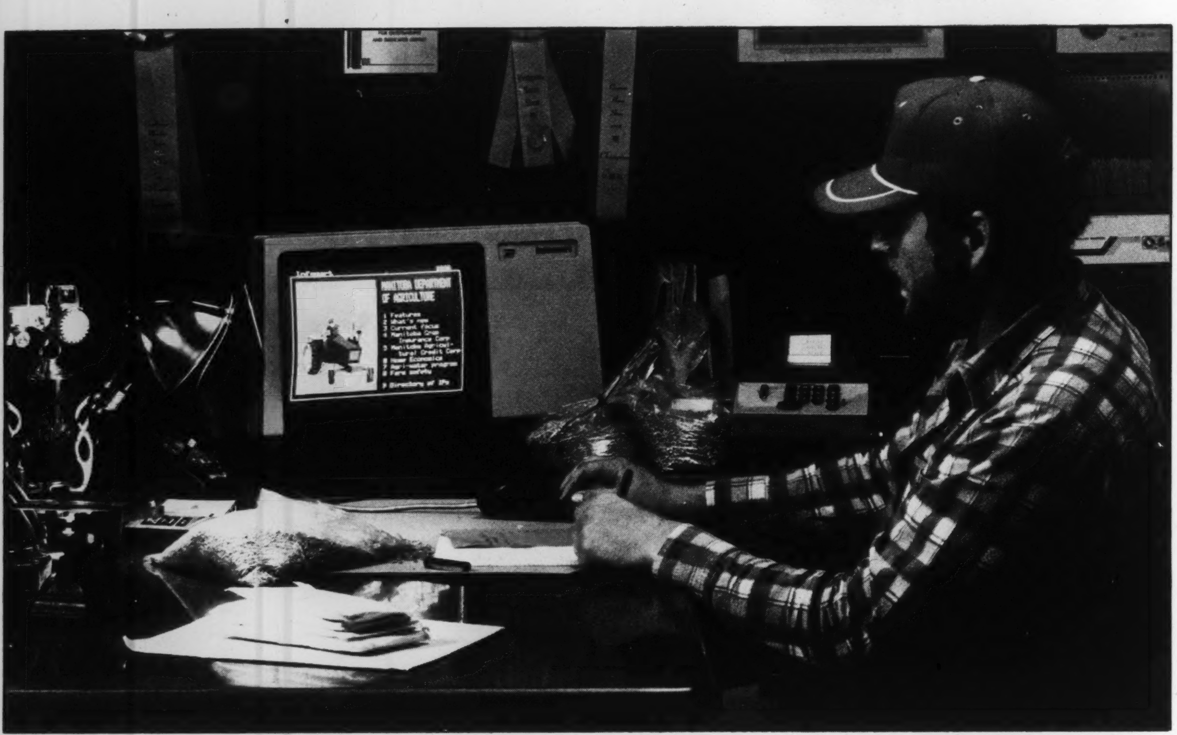
Farm Videotex: As American As Apple Pie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8 Farm safety
9 Directory of IPs

G. Berton Latamore

Microcomputers and videotex computer communications are sweeping across rural America with the speed and irresistible power of spring. Microcomputers are selling at least as quickly in rural towns as in big cities. Numerous farm-oriented software houses, most run by farmers, have sprung up. Computer classes are appearing in schools throughout rural North America, and they are very popular.

In computer communications, a surprising array of farm-oriented videotex experiments ranging from very localized services to national databases, have appeared, and more are planned. Two have already become commercial successes.

Farmers are turning to computers and computer communications out of necessity. Today's farmer must negotiate the complexities of a world agricultural market in which his best customers may be foreign governments and a financial situation in which the costs of his necessities, including diesel fuel, equipment, and land, have increased much faster than his gross income. He is physically isolated, making exchange of news and ideas difficult. A large percentage of his net business worth is tied up in capital equipment which must be replaced periodically at current high prices and interest rates. His assets are in land, he lacks the liquid assets needed to take advantage of investment opportunities. He must pay high interest rates for the short term loans he needs each spring to gain operating capital for the growing season.

A $5000 microcomputer is a small investment compared to a $50,000 combine.

Finally, unless he is a dairy farmer he must put all his eggs in one basket. His entire year's financial success or failure depends on the commodities market on the day he sells his crop. That market is complex and volatile—in a few hours prices can change enough to make the difference between profit and loss.

The farmer has several reasons for turning to computers to help him with these problems. He tends to solve problems with machinery. When he wants to increase productivity he buys a machine to do it. A $5000 microcomputer is a small investment compared to a $50,000 combine. He is familiar with computers. The agricultural programs at the land grant colleges where many U.S. farmers are educated have been using them for 30 years, and many farmers use timesharing services offered by these institutions to do their year-end bookkeeping.

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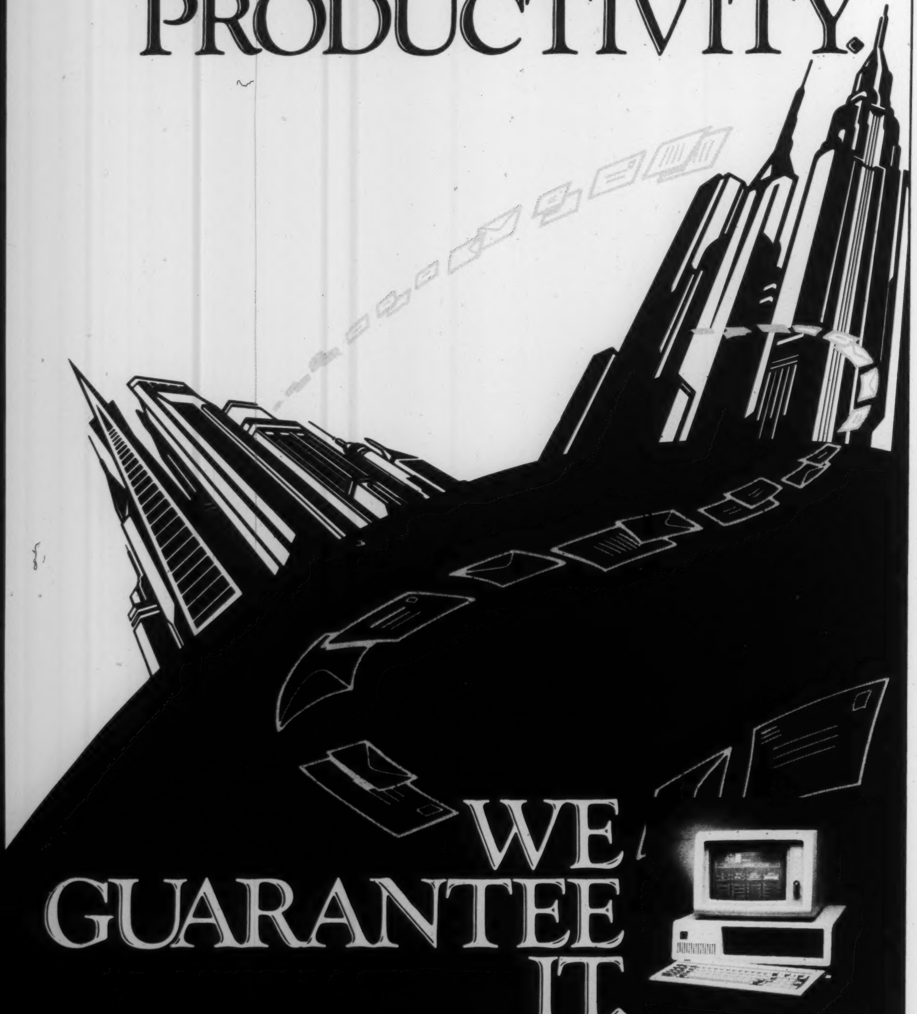

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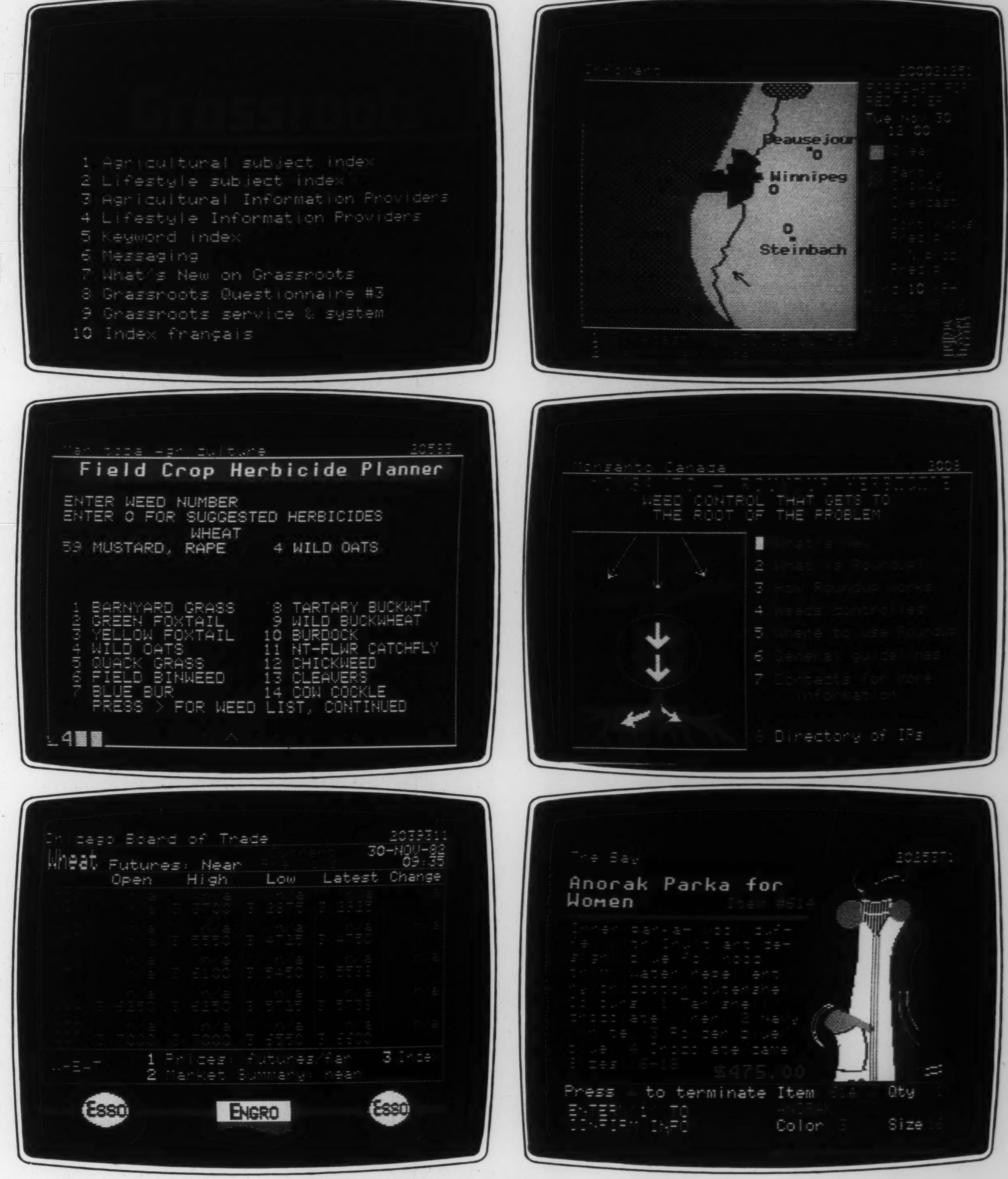

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 1 Agricultural subject index
 2 Lifestyle subject index
 3 Agricultural Information Providers
 4 Lifestyle Information Providers
 5 Keyword index
 6 Messaging
 7 What's New on Grassroots
 8 Grassroots Questionnaire #3
 9 Grassroots service & system
10 Index français
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  Field Crop Herbicide Planner

ENTER WEED NUMBER
ENTER 0 FOR SUGGESTED HERBICIDES
               WHEAT
59 MUSTARD, RAPE      4 WILD OATS


 1 BARNYARD GRASS     8 TARTARY BUCKWHT
 2 GREEN FOXTAIL      9 WILD BUCKWHEAT
 3 YELLOW FOXTAIL    10 BURDOCK
 4 WILD OATS         11 NT-FLWR CATCHFLY
 5 QUACK GRASS       12 CHICKWEED
 6 FIELD BINWEED     13 CLEAVERS
 7 BLUE BUR          14 COW COCKLE
   PRESS > FOR WEED LIST, CONTINUED
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Monsanto Canada                     2008
      WEED CONTROL THAT GETS TO
       THE ROOT OF THE PROBLEM

         2 What is Roundup
         3 How Roundup works
         4 Weeds controlled
         5 Where to use Roundup
         6 General guidelines
         7 Contacts for more
              information

         8 Directory of IPs
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Chicago Board of Trade           2039311
                               30-NOV-82
Wheat Futures: Near                09:35
        Open    High    Low   Latest Change

            1 Prices: futures/far    3 Index
            2 Market Summary: near
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The Bay
Anorak Parka for
Women               Item #614

                  $475.00
Press   to terminate Item          Qty  1
ENTER 1 TO                ANORAK
CONFIRM INFO              Color        Size
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Canada's Grassroots systems mixes agribusiness with home services.

The most potent reason, however, is that computers and computer communications offer many real advantages. Videotex services can bring up-to-the-minute market quotes, world weather, mainframe ecological and financial models, even store catalogs, into his home. These services make videotex a significant new tool in his struggle for economic survival.

A variety of videotex services ranging from the local Harris Electronic News or HEN of Hutchinson, KS, to the million-

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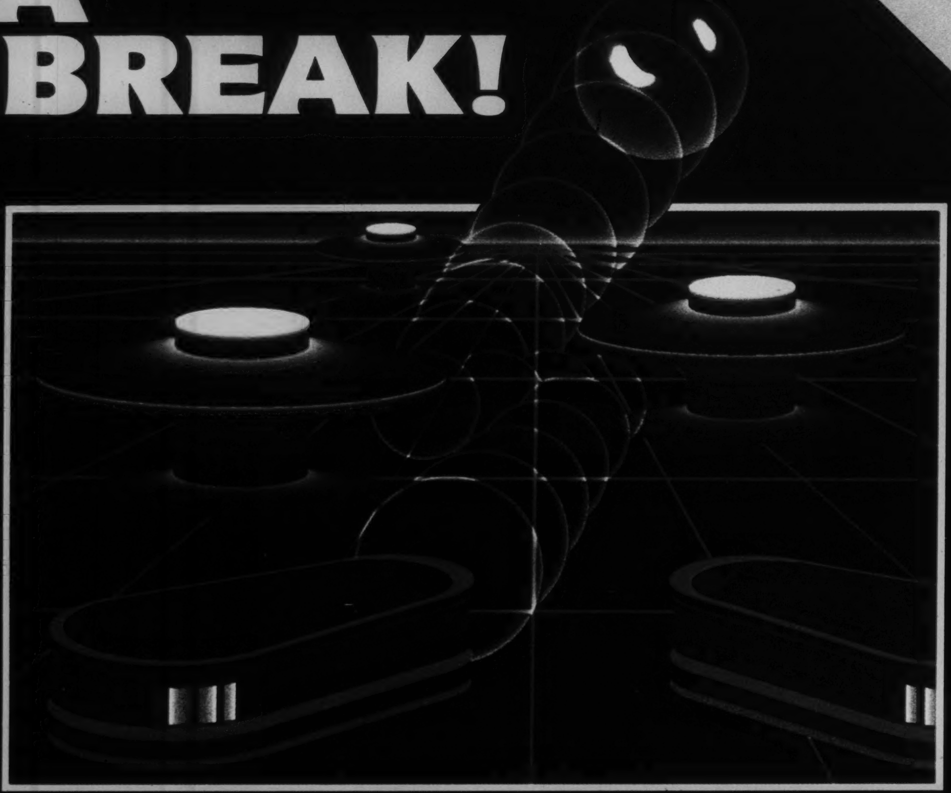

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page AgriStar system have appeared in the last two years to meet the needs of farmers. Most are local, designed to serve the needs of a specific agricultural community, and newspaper-owned. Several of them use TRS-80 computers and videotex terminals.

The Tandy equipment is both inexpensive and proven—advantages that are more important than technical sophistication and large memory capacity for small, experimental databases.

Harris Electronic News

HEN is typical of a class of approximately five small, rural services. A creation of the Harris Newspaper Group, which publishes 11 papers, most of them midwestern dailies, it is aimed directly at the Kansas farm community. Mike Hurd, its editor, describes the contents of HEN as being very different from the contents of a newspaper.

"News, weather and sports are readily available elsewhere," he says. "We offer an information package for the professional in agribusiness based on commodities market reports which we update throughout the day."

HEN carries selected U.S. Department of Agriculture (USDA) reports, which its staff enters manually into the TRS-80 Model II computer that holds its database and controls the system. It does carry some news, but even its weather reports are different from those in the newspapers or on television. Supplied by Weatherdata, Inc., of Wichita, HEN weather is designed for the farmer and includes such information as a detailed analysis of soil conditions and interpretation of weather predictions in terms of effects on crops.

On February 14 HEN launched "The Monitor," a business and financial section of the database that carries reports on 300 stocks as well as precious metals, and currencies; commercial weather services; and expanded news and sports.

"We offer something for anyone with an interest in business or agriculture," Hurd said.

HEN has steadily added technical abilities along with database expansions. Originally HEN was a non-interactive, preprogrammed service that could be received only on TRS-80 videotex terminals and computers. The user programmed his terminal to access the information he wanted before calling the database. When he logged on, HEN dumped the requested data into the memory of his terminal and signed off. The system did not allow the user to communicate interactively with the database, precluding electronic mail, banking and shopping and financial modeling.

HEN is one of the first Tandy-technology systems to upgrade to interactive service using new Tandy-supplied software. It also became accessible to non-TRS-80 computers in December. Hurd expects to add an automatic logging facility soon. This will track system use by database area, showing the staff what is popular and what is not.

For the farmer, timing and a good market strategy are essential to economic survival.

"The Tandy equipment really works," Hurd said."Tandy gives us good support."

So far HEN has attracted 120 subscribers and is still in the experimental stage, far from turning a profit. Interest runs high in the Kansas farm community, however. When HEN staff members put on demonstrations at fairs and other public events, they inevitably draw crowds and favorable comments. They hope to get computer stores across Kansas to sell HEN subscriptions, making the service easier to subscribe to.

"The level of interest in HEN among farmers is really terrific," Hurd said, "much higher than our circulation figures indicate."

Instant Update

Not all farm videotex databases are experimental. The first, and so far only, successful North American commercial videotex systems are agricultural. One uses Tandy technology.

Instant Update is a daily electronic newsletter covering all aspects of agricultural marketing. With more than 1000 subscribers nationwide, it has one of the largest videotex circulations in North America.

The reason for this success is simple: *Instant Update* fills a major information need in agribusiness.

Owned by Professional Farmers of America (PFA) of Cedar Falls, IA, a publisher of market news and information, *Instant Update* is very selective in its contents. It lists commodities prices from the major U.S. markets including the Chicago commodities exchange and the major East, Gulf and West Coast ports. Prices are updated every 10 minutes. It carries a variety of agriculturally-oriented news reports including an Alert Page of news of special importance to farmers and a weather page. Its Washington Watch carries stories from the parent company's Washington Bureau on federal government activities affecting agribusiness.

Commodities market analyses are the heart of *Instant Update*, however. In recent years the agricultural markets have been very unstable. For the farmer, timing and a good market strategy are essential to economic survival. To help him formulate that strategy, *Instant Update* carries both fundamental (supply and demand) and technical (special indicator based) analyses. The fundamental analysis shows general, long-range marketing trends. The technical predicts specific, short range activity. Together they are valuable tools for dealing with the market.

Rex Wilmore, PFA vice president, says *Instant Update* is satisfied with the Radio Shack equipment in spite of its lack of graphics and other limitations. Others, however, are not.

Grassroots

North America's other commercial videotex network is the result of a collaboration between Canada's Manitoba Telephone System and Infomart, the Toronto-based supplier of Telidon videotex turnkey systems. Named Grassroots, it is a technically sophisticated service designed to serve Canada's agricultural heartland. Unlike the Tandy systems, which use only black-and-white alphanumeric characters, Grassroots offers high-level color graphics made with alphageometric primitives, tiny predetermined segments of lines and curves that allow fast transmission and build-up of realistic pictures. Screen generation is fast enough to give an animation effect, while pixel-addressing would slow transmission to the point where each screen would take more than a minute to build.

Grassroots was a financial success from the moment its status changed from experiment to commercial service in September 1980. Today it has more than 1000 users and is expanding beyond Manitoba into neighboring Ontario and Alberta. Infomart is negotiating with potential partners in the U.S. to bring Grassroots into this country later this year.

Grassroots achieved this success with a 20,000 page database containing a mix of high quality agribusiness and home services including several that take advantage of the full interactive capacity of the system. Professional services include constantly updated commodities market quotes and color graphing of 10- and 40-day moving point averages and 100-day price averages.

It carries the latest farm bulletins and stock quotes from the Toronto Stock Exchange.

Its weather service, provided by World Weather Watch of Quebec, has earned a reputation for accuracy by being right when the local radio and television forecasters were wrong. World Weather Watch provides separate forecasts for areas as small as 50 square miles and summary reports for the wheat-growing regions of Russia and Argentina so the Canadian farmer can get some idea of what to expect from his competition.

For the home, Grassroots includes games, educational programs, restaurant reviews and teleshopping from an electronic catalog supplied by Hudson's Bay Co., Canada's largest retail chain. This catalog takes advantage of Telidon's graphics to provide full product illustrations. It has an electronic order form that allows the user to order merchandise on line and charge it on his Hudson's Bay charge card.

Grassroots also offers a popular electronic mail service and carries the Canadian Press wire service.

Bakersfield Californian

Infomart's experience with Grassroots is standing the company in good stead in California, where it is working with the Bakersfield *Californian* to create a videotex database to serve the prosperous farmers of the San Joaquin Valley. Known as America's vegetable basket, the region offers a unique challenge. Here almonds grow alongside cabbages, and farmers often plant and harvest two different crops in the same field in a year. Such diversity in a small area creates serious ecological concerns. A fertilizer or pesticide that is beneficial to one crop may be dangerous to the crop next door or the next crop planted in that field. Even water must be allocated with one eye on the next field over.

The *Californian's* videotex subsidiary, Viewcom, plans to meet the information needs of this agricultural community with a database divided equally between farm management and agricultural information. The service, tentatively scheduled to go on line in the first quarter of 1984, will carry listings from the Comdex, New York, Chicago Board of Trade, Mercantile and Mid-American markets. Like Grassroots, it will carry an extensive weather service. It will also carry detailed crop information.

Telidon's graphics capability will be used sparingly and only where it will provide extra information. For instance, Union Carbide has tested a tutorial with graphics showing the relationships among root depth, plant height and depth of water in furrows beside the plant. Graphics will be used with text on the same page rather than on separate full graphics pages. Where graphics are not necessary, such as in the news section, they will be limited to borders.

Agristar

The most ambitious farm videotex program in North America in terms of database size, is a national system that started commercial operation in November 1982. With 30,000 continuously updated pages on line and a growing database expected to top two million pages by year's end, this system, called AgriStar, should become the most complete database in agribusiness. Size is only part of the difference, however.

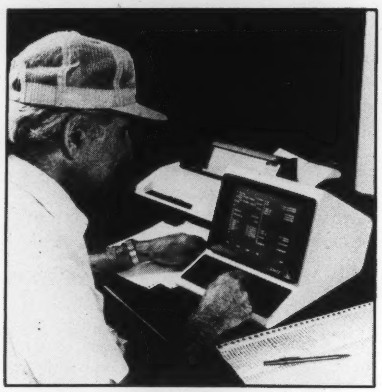
Created by AgriData Resources, Inc., Milwaukee-based publisher of *Farm Futures* magazine and several daily, weekly and monthly farm business publications, it is fully interactive, designed to serve a full range of professional farm needs from market reports to electronic mail.

AgriStar is a basic information management tool designed to meet modern farm business needs.

"AgriStar is the only commercial online database of national scope in America," says Richard W. Weening, AgriData president. "It is designed to function as a utility, allowing the farmer to get what he wants when he wants it."

AgriStar can be divided into three sections. A large portion of the database is devoted to continuously updated news pages. This electronic newspaper includes reports of events of importance to the farm community, a full set of market quotes, and graphs of moving point averages, volumes and opening and closing prices.

This news and interpretation is backed up by a large volume of background material including fact sheets on fertilizers and pesticides and USDA reports. AgriStar is negotiating with the USDA and Bureau of the Census to receive all their public reports electronically directly from the agencies' databases.



A farmer uses AgriStar to check commodity prices.

AgriStar also offers a library of microcomputer programs that can be downloaded. These include programs to automate such agribusiness functions as stock management, loan analysis, and bookkeeping.

"AgriStar is a basic information management tool designed to meet modern farm business needs," Weening said. "Today farmers have to adopt the technology of business to survive."

The Future

Videotex services are definitely a part of the future of commercial farming. While the exact service mix and best system technology may still be subject to debate, few question that tomorrow's farmer, whether his product is beef or roses, will need videotex. This new communications technology, however, may do much more than provide information. It will give the farmer a fast, convenient communications medium that will allow him to reach others with similar interests regardless of the distances involved.

Special interest groups using electronic mail facilities similar to those already popular on such urban-oriented services as CompuServe and The Source will allow farmers to discuss issues of common interest and formulate common courses of action.

On a more basic level, videotex will allow farm family members to meet others who may live hundreds of miles away but who have much in common with them. It can provide a new social outlet for these physically isolated people. Yet because it is always under the user's control, it will not intrude on the individual's privacy. Videotex may well end the farmer's isolation and turn the North American farm belt into a series of interlocking electronic villages that will provide a model for the society of the future. END

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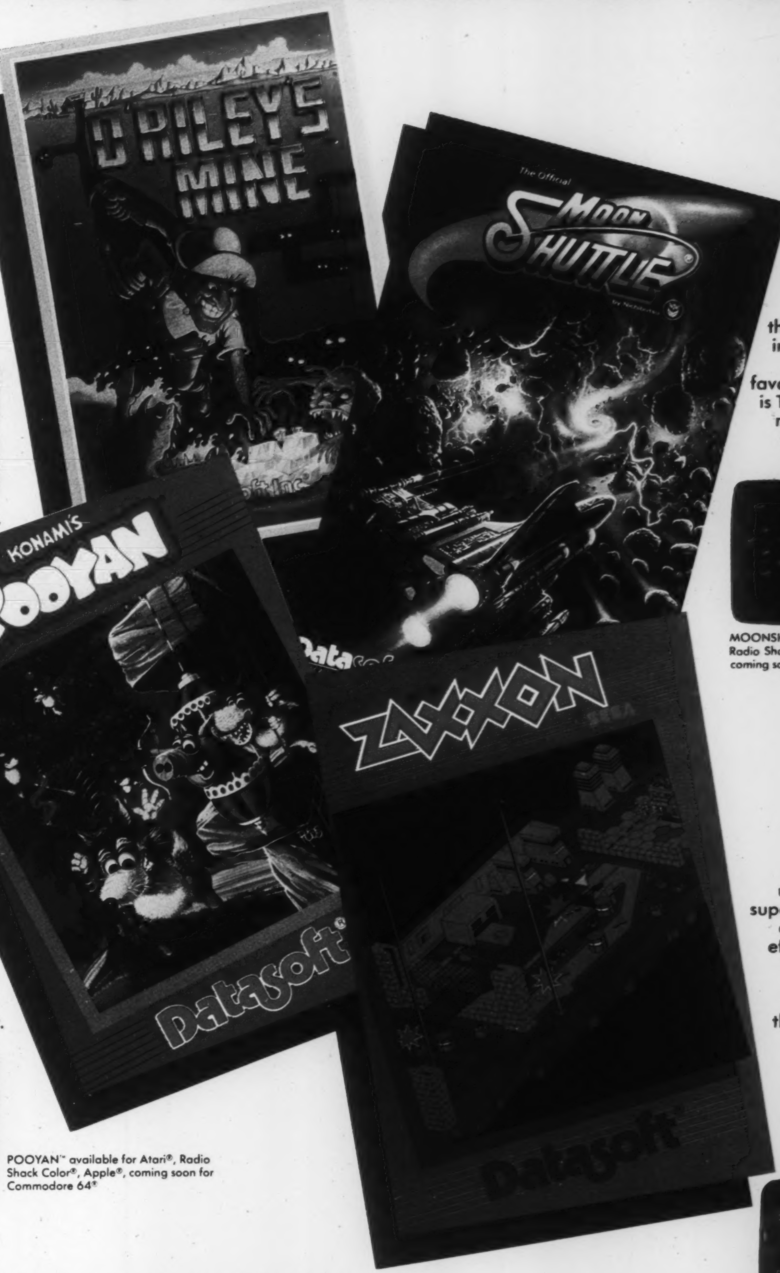

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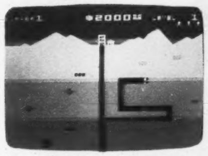

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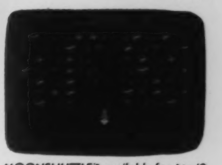

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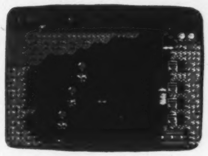

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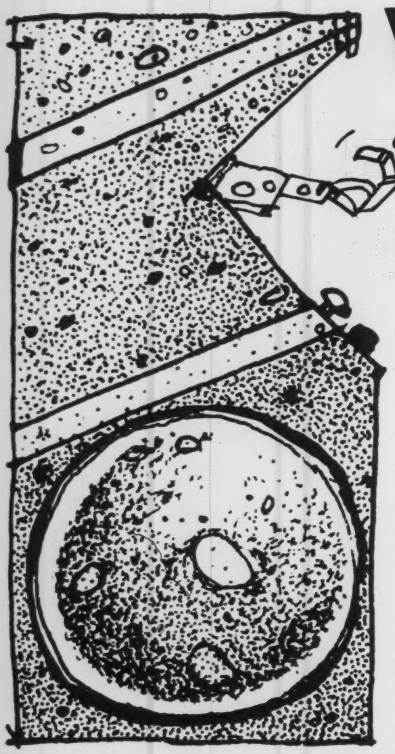

Videogames: Knowing the Score

Glenn Adilman

Steve Juraszek, 15, recently played Defender for 16 hours and 34 minutes on the same 25¢, ringing up a score of 15,963,100 before he finally made a mistake and lost his last ship. Juraszek started playing Defender in June and by August he was pretty good . . . " I could buy a car or something with the money I've put into games," he says with no appearance of regret . . . On his record day he kept up his strength by snapping at pizza slices that people held in front of his face. He said later that he was so excited he never even thought about going to the bathroom. His mother, Joanne Juraszek, watched for a while, utterly unimpressed, and agreed reluctantly to let him play till he dropped. "I just wish," she said later, "that he was this good about doing his homework."[1]

Defender is an attack-from-outer-space game. Bombs and beams are hurled at the player who controls a small cannon-firing jet plane that, while flying at varying altitudes and speeds, will shoot down a huge variety of alien bad guys, each with his own pattern of behavior.

The player manages a joystick that determines altitude as well as five separate buttons that fire the cannon, change forward thrust, reverse direction, throw the ship into hyperspace and fire a limited supply of bombs designed to blow up everything in sight. Like all video games, Defender shifts to subtler strategies and faster speeds as the game progresses.

The video game industry is huge, lucrative, and growing at astronomical rates.

To be sure, Steve Juraszek is not the only video games addict, nor is Defender the only popular game. The industry is huge, young, lucrative, and growing at astronomical rates. In 1980 alone, $2.8 billion in quarters, triple the amount of the previous year, was fed into video games. That represents 11.2 billion games, an average of almost 50 games for every person in the U.S. And 86% of those aged 13-20 played at least one arcade video game in 1980.

By 1981, $5 billion was spent on 20 billion games, representing 75,000 man *years* of playing time. This $5 billion represents twice the reported take of all Nevada casinos in the same period, almost twice the $2.8 billion gross of the U.S. movie industry, and three times more than the year's combined television revenue and gate receipts of major league baseball, football, and basketball. The same year also saw an additional $1 billion spent on home video game consoles; in 1982 sales were in the neighborhood of $3 billion. Further, more than 9% of all U.S. households with a television set had a video game attachment in 1981; that figure is now closer to 15%.

Arcade game makers, arcade operators, home console manufacturers, and home game cartridge designers have all prospered. In early 1981, 60,000 As-

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[1] John Skow, "Those Amazing Video Games," *Time*, Jan. 18, 1982, p. 51.

Glenn Adilman, Columbia University, 100 W. 80th St., #42, New York, NY 10024.

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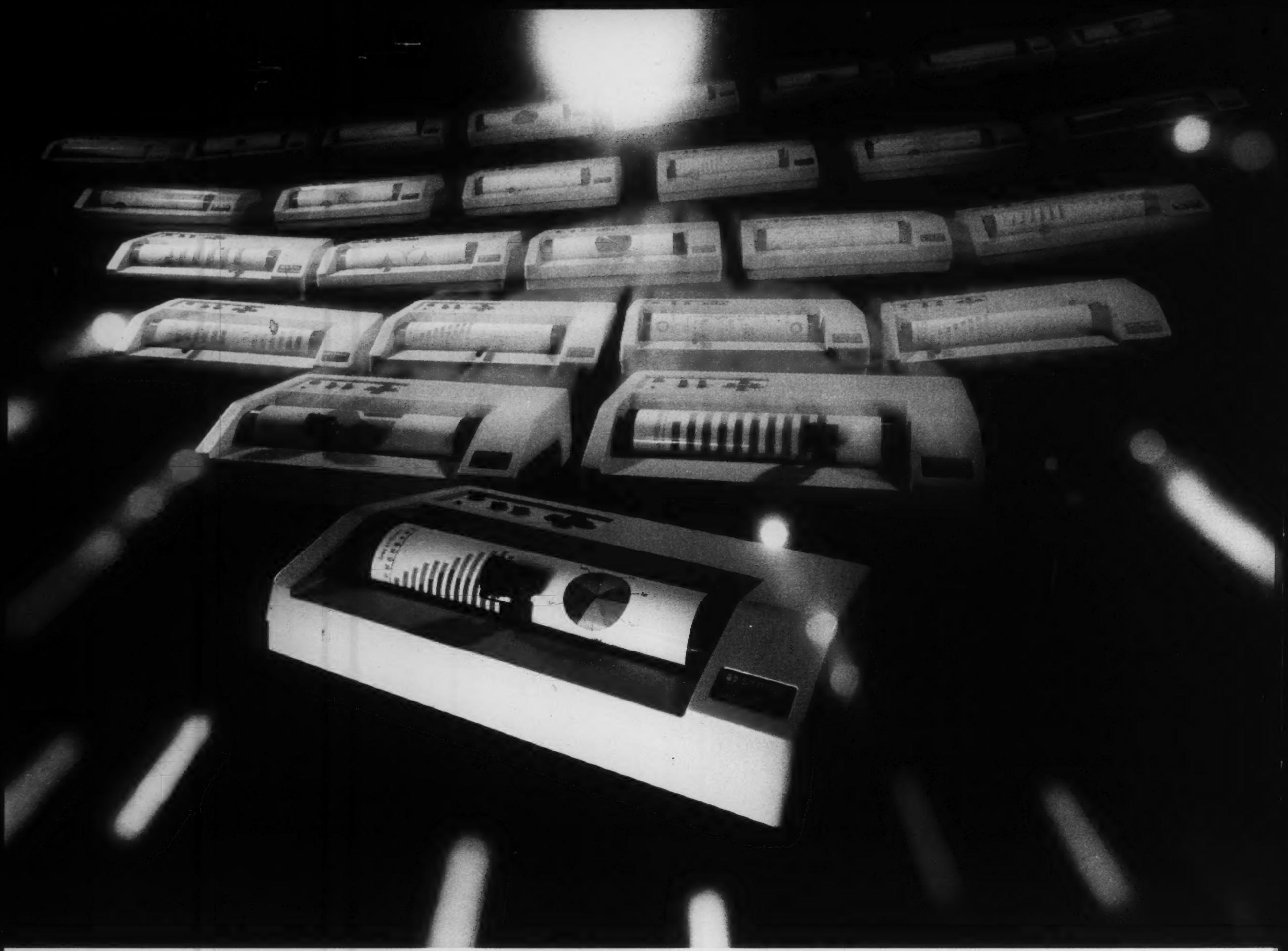

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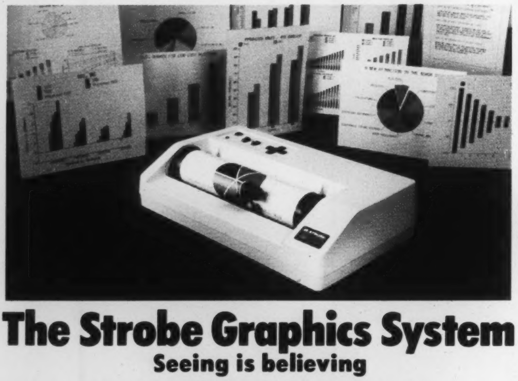

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teroids machines on location worldwide were each bringing in $1000 per week. Its first year in the arcades, Midway's Pac-Man pulled in nearly $1 billion.

Midway's Space Invaders, the first massively popular video game, sold more than one million cartridges in its first year. One successful cartridge such as this can generate $100-$150 million in sales with 20% margins. Activision, one of the most successful manufacturers of software for the VCS, forecasted sales of five million units for its fiscal year ending March 1982, generating revenues in excess of $50 million, more than 60 times its original investment.

Why Play?

There are very real, unique reasons for the popularity of video games, reasons and motivations not fulfilled by other amusements. An analysis of why people play video games will better explain their addictive nature, their effect on alternative forms of entertainment, and the inevitable social controversy.

Challenge. As pinball machines were the playthings of the industrial revolution (players matched mechanical skills with a machine), computers are the playthings of an information revolution. It is this formidable, personal, intellectual challenge in which players match wits with an intelligent machine that seems to be the main attraction of video games. They require skill, involve strategy, and challenge reflexes. Video games are tough!

The quality of this one-on-one interaction should not be underestimated. The challenge provides a genuine opportunity for a sense of achievement—a chance to feel good about yourself when you do well. This is especially true for non-athletes who traditionally have few opportunities to show off.

Entertainment. Regardless of challenge, the video game experience is sheer entertainment. The games are a fun, exciting, enjoyable diversion. For the lonely, the video game is a friend; for the bored, it is something to do. And it provides a universal experience of pure sensory stimulation: The bright colors, flashing lights, realistic images, frenetic graphics, and amazing sounds are all thrilling.

The Ms. Pac-Man arcade game, the sequel to the currently popular Pac-Man, taps directly into this need for entertainment. "Along with a new sound package," the distributor brochure describes, "players may witness the touching love story of Ms. Pac-Man's meeting Pac-Man himself, their courtship and marriage and even the delivery of Pac-Baby in the three act, between-maze cartoon series."

The entertainment style of video games is unequalled by other diversions. Video games represent a form of active, participative entertainment replacing the passive experience of watching a movie or television show. "For so much entertainment," psychologist Robert Gable explains, "we are programmed just to sit. With these games, you can input. The player has a lot of control. And control is especially important for teenagers."

Control, escape and fantasies. Nolan K. Bushnell, the creator of an early video game (Pong) and founder of Atari, agrees. "The games are a search for mastery . . . over the computer. This is what people are subliminally dealing with when they play video games."

Video games provide an opportunity for control unmet by most other amusements. Sociologists expand this scope of control, asserting that video games provide the escape and fantasy which induce a much needed sense of control over life in general. Aaron Latham, writing for the *New York Times Magazine,* made sense of things this way: "The need to escape into a microworld increases as the life-size world gets more confusing and out of control. As we move ahead into an intimidating future that will be dominated by the machine, the machine provides the perfect escape from that world."

For the lonely, the video game is a friend.

Fantasies are an integral part of this escape. Almost everything about a video game is conducive to a good, self-serving fantasy—the intimacy of the relationship, the vulnerability, the responsiveness, the power and aggression, the sounds and colors, and of course the control. For some, the emotional rescue provided by a video game—the sense of getting something out of your system—can be a real saviour. As one 16-year-old says, "It can take the anger out of you."

50,000
100,000
200,000...
$

Playing In The Arcade

The experience of video game play is tightly related to the consumption environment. The arcades are everywhere!

For a video game addict, the arcades are paradise. Mitchell Robin, a New School psychologist, says, "The arcades are addictive; the lights, the sound—that all makes it womblike. Every generation needs a refuge and at least in this one, the kids can learn about accomplishment." Refuge or not, the arcades have become hot new hangouts.

In Madrid, for example, they have replaced pool halls as the traditional lounging places; in Amsterdam, they are the new spots for homosexual cruising. In America, even, they are places to express rebellion and independence. If the games become respectable, some psychologists think, the arcades will lose their mystique.

Age. Though 80% of arcadians are teens, and nine out of ten teens have tried arcade games at least once, more and more lawyers, bankers and other corporate types are backing out of expense account lunches and client meetings and becoming lunchtime regulars at local arcades.

Sex. Male arcade players outnumber females twenty to one. Moreover, only a few isolated games are played or enjoyed by women. Both sexes offer several explanations of this phenomenon. Men claim that women are not conditioned to be comfortable with complicated gadgets or to play shooting games. They think that women are too literal-minded to enjoy the harmless fantasy of video games and that, since they really don't know how to play, they are afraid to look foolish in public.

Women (not to be outdone by the men's chauvinism) brag that they are just too sensitive to enjoy the bloodthirsty games. They compare the machines to black holes, soaking up men's money and making them act like little boys.

The Well Designed Video Game

Whether a video game appeals to young or old or men or women, there are some consistent traits that will make it a winner. Above all, it must be continuously challenging so as not to bore the experienced player. The best games are almost, but not quite, impossible to master.

Lyle Rains, vice president of engineering at Atari, puts it best: "You want to develop a healthy level of frustration. You want the player to say, 'Gee, if I put another quarter in, I might do better.'" The best machines intensify this challenge by automatically becoming more difficult as a game progresses. In some cases, the computer even alters its style to take advantage of a player's weakness.

Whether or not you are a sensation seeker, the allure of video games is mostly due to the sound effects, color, and graphics. The more imaginative and playful, the better. Mattel's Intellivision is known for bright and imaginative sound and graphics. And because it has developed these qualities, Intellivision has produced some of the most realistic games in the industry, a characteristic important to many discriminating players.

Creative and popular themes are also important. And since many of the space, battle, and fantasy formats have been milked dry, it is important that themes be clever and imaginative rather than trendy.

Perhaps Space Invaders was the first video game superstar because it combined all of these characteristics. Its difficulty, intensity, sound, colors, space motif, and sophistication all served to make it a classic.

Addiction

Space Invaders, like all the good video games, is surprisingly addictive. The unrelenting challenge of the machine and the player's compelling desire for control become obsessive. In general, the difficulty of a well-designed game and the excitement of the arcades come together as a powerful, captivating diversion.

Ann Williams, a Tupperware saleswoman who once spent $15 in one session, concedes her dependence without a trace of guilt. "It's my money," she argues. "I earned it. There's not a lot of fun things in life. It's taken away my boredom. I've never been as serious about anything as Space Invaders."

Addiction can be even more serious: Reports of children stealing money from parents or building large tabs of credit at local arcades are common. And there is one story of a 17-year-old boy who became so infatuated, he refused to attend school or see any of his friends.

Recognizing the intensity of the consumption experience and the unending challenge of video games, many of the major publishers have jumped in to offer professional help. Simon & Shuster's *How to Win* guides to the top ten video games, Bantam's *How to Master the Video Games,* Simon & Shuster's *How to Beat the Video Games,* Creative Computing's *Guide to the Video Arcade Games,* and Signet's *Mastering Pac-Man* by *Creative Computing* Editor-at-Large Ken Uston have all found avid readers searching for key strategies.

Perhaps the first of the truly hypnotic, mind-bending video games was Atari's free-moving, non-linear Asteroids, which was also the first arcade game to invite top scorers to record their initials on the screen.

Though all the good video games claim their own devotees, Asteroids has clearly attracted the most single-minded and crazed following. Also more than any other game, it opened the coin-op market to a brand new clientele, responsible, well-paid professional men.

As one executive explains, "I've pretty much eliminated lunch as an ongoing part of my daily routine. I'd rather play this game than eat. Along about 4:00 my stomach begins to growl, but Asteroids has made me a happy man." Similar stories reveal grown men who cannot pass bars without looking inside for the familiar machine; other adults have claimed cravings so strong they are unable to control them.

I'd rather play this game than eat.

Doug McIntyre, the international marketing manager at Time Inc. is not ashamed to admit that the game is a pressure-releasing escape. "Asteroids is a drug," he explains. "When you play the game, the rest of the world ceases to exist. You can't even hear what's going on around you."

The sounds of Asteroids are breathtaking; there are eleven of them. Perhaps their angina-inducing tempo and hypnotic, pulsating beat are a major part of the attraction the game holds for so many. The simplicity of Asteroids, the opportunity to place yourself right into the action, gives many players immediate satisfaction. The game can turn anyone into the commander of a troubled spaceship.

Exploration

Video games have Hollywood and network television executives worried. Perhaps movie attendance and lower television ratings can be blamed on Galaxian and Donkey Kong. As the home cartridges become more entertaining than *Laverne & Shirley* (is this possible?) and some uninspired cable programming, viewers' television sets may turn into permanent intergalactic battlefields.

Video games represent a new form of American recreation. In terms of exploratory behavior, video game consumption is a sophisticated, compelling, and challenging style of play.

Theory

Because humans embellish objects with fantasies and daydreams, play is extremely important. Play becomes more challenging and complex as people grow older. The continuous acquisition of knowledge and experience suggests that as time goes on fewer potential experiences seem new. As a child grows up, he must increase his efforts to achieve the

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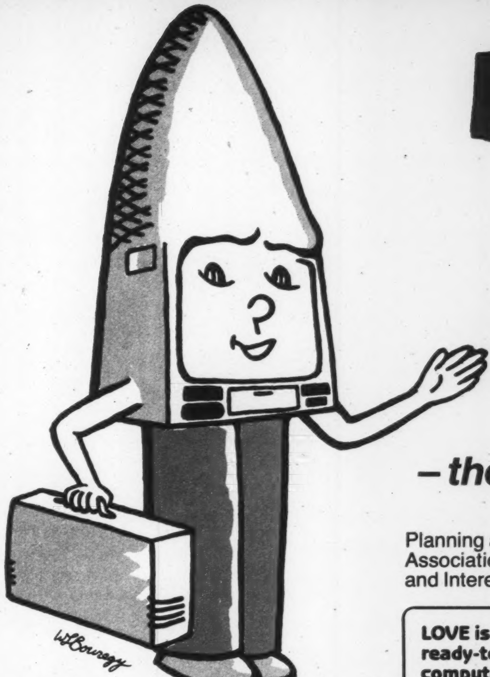

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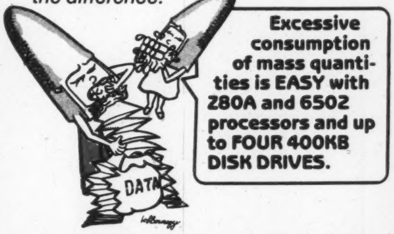
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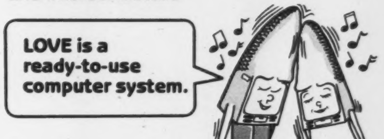
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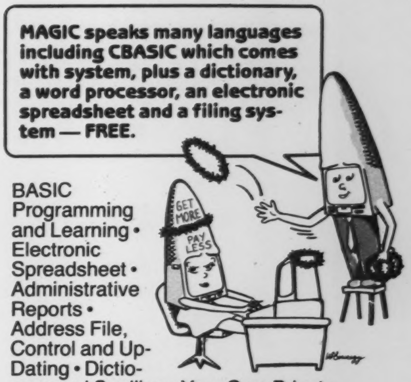
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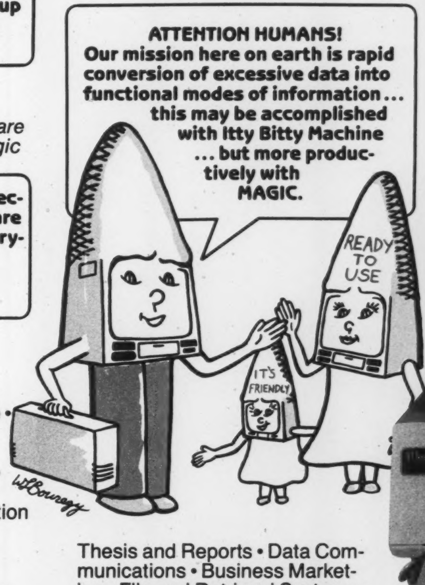
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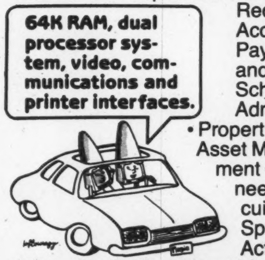
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satisfactions gained from play (and other forms of exploration.) For teenagers and adults, then, play activities must be sophisticated and involving. Although other amusements may be more physical, more glamorous, or sexier, they do not provide the ever-increasing challenge of video games. Compared with other forms of teenage and adult entertainment, the games satisfy with much less effort.

Compared with other forms of entertainment, games satisfy with less effort.

Variety

In a theoretical framework, video games are supported as a powerful form of exploratory behavior. For novelty, they offer a sensory, strategic, and intellectual experience unparalleled by most forms of play. In terms of surprise, each game is completely different; you never know what is going to happen next. In terms of complexity the games demand rigorous concentration, coordination, and experience. Asteroids and Missile Command, for instance, are unmanageable and frustrating for the novice. Incongruity manifests itself in some of the themes of fantasy or violence in the games and in some of the bizarre sound effects. For example, if you leave the maze of Berzerk without destroying all of the robots, the machine says in a deep monotone voice, "Chicken! Fight like a robot!" Variety seeking, then, is an integral part of exploratory behavior and is greatly fulfilled by video games.

Entertainment

Video games have become a popular entertainment alternative. They provide a quick, relatively inexpensive form of play. For kids who are bored with the usual play activities, they are a thrill. As one 16-year-old put it, "there's nothing really to do during the day. We can go to the park and play basketball or come here (to the arcades)."

An adult bored with his leisure activity agrees. During lunch hour, "you could walk around and look at girls all day, but sometimes you need a diversion," he explains.

With two-career families, rising movie and threatre prices, and fluctuations in the cost of gas, the home entertainment market is growing. And home video games, partly because of their comparatively low price, seem to be the revolution in home entertainment options. Many people prefer home video games to commercial television that is traditionally unimaginative. Games are more entertaining for kids and more relaxing for parents. Moreover, kids can invite friends to play at home rather than outside while parents are at work.

Controversy

Views on video game consumption are mixed. Not all parents see video games as constructive. However, some parents, psychologists, sociologists, and even the Defense Department have defended the games. Video game consumption has surfaced as a serious, explosive political and sociological controversy, and the debate continues.

Morals. The most emotional argument is that the games harm players' morals, faith, school attendance, and general well being. Parents, clergymen, den mothers, the PTA, and local politicans have all found platforms with this argument.

The argument applies especially in the international market. In Stockholm, for example, the public associates video games with juvenile delinquency—the use of drugs, prostitution, and hard liquor. In the Philippines, video game play is considered the tragic result of the "ravages of a destructive social enemy." Outcries of indignation caused President Ferdinand Marcos to ban the machines completely; he gave owners two weeks to smash them.

The arcade environment perpetuates this argument—and sometimes justifiably. When kids run out of money, the arcades become hangouts. Yet most arcades have no bathrooms, water, or security, and some lack heat. Some arcades are controlled by organized crime or managed by dubious characters, with whom kids must interact. In Chicago, where no police check is run on the background of license applicants, several arcades are run by ex-convicts. Some parents also assume that beer and dope are passed to youngsters in the arcades at night; in some cases they are right.

Money. A survey of fifth graders showed that $3 is the "minimum satisfactory amount" to take into an arcade; several children, however, said they spend $10 to $20 in one visit. It takes $20 to $50 to become proficient at any game challenging enough to be fun. To parents, this is a disaster. Many kids are spending their lunch money and allowances entirely on video games.

Minds. A more serious, long term problem is the effect of games on the minds of players. Some critics assert that the games blunt young people's minds. They suggest that the games reduce kids' attention spans so that interest can be held only by a continuous flow of sounds, colors, and motion. Parents tell stories of active, bright youths who can interact only with machines. Some psychologists fear that disturbed youths may dodge reality and human contact through video games.

Violence. Video games, like Saturday morning cartoons, glorify violence. A common thread through most games is the continuous "kill or be killed" theme. This is not a positive, pleasant preoccupation, and its impact on the hearts and minds of video game users is unknown.

Gambling. Though the machines deliver no financial payoff and rarely offer free games, gambling is another criticism of video game consumption. A restrictive ordinance in Irvington, NY was enacted "to protect the adolescents of the village against the evils associated with gambling." Compulsive gambling can, in fact, begin in children as young as ten. Unfortunately, Gamblers' Anonymous has already seen youngsters who are hooked.

Medical. Finally, there is the dubious issue of medical concerns. The possible effect of the screens on players' eyes is still unknown. "Pac-Man elbow" is a common discomfort in arcade circles. Further, the *New England Journal of Medicine* has diagnosed "Space Invaders wrist," a malady caused by "minor ligamentous strain of the joint from repeated and prolonged playing." The cure: a week and a half of abstinence.

In Defense Of Games

The six areas of support for video games seem much less extreme than the negative views.

Fun. Perhaps the most sensible but least sophisticated defense of video games is that they are wildly entertaining. Kids enjoy the games—so why deny them? Video games are good, relaxing recreation after school. They are helpful and therapeutic. They are something to do for those who are lonely; a tension release for the frustrated and violent. For antisocial children, video games represent something to which to relate. Like meditation, games are a great way to clear the mind. And they offer

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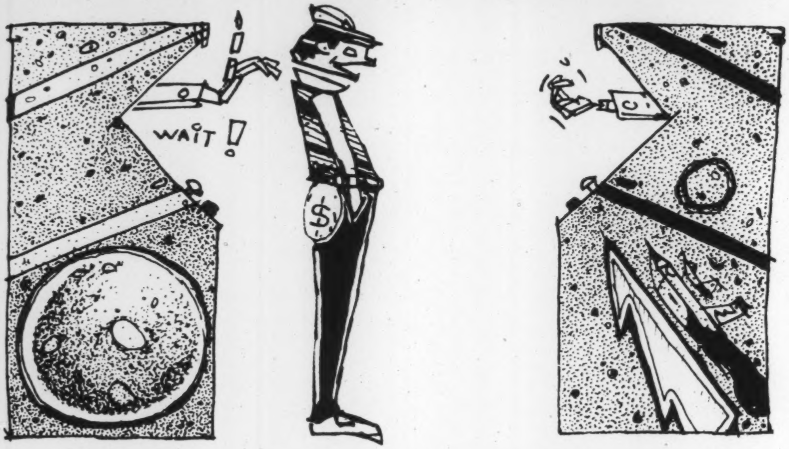

encouragement and an experience of mastery to kids who may not find this anywhere else.

Safety. Not all arcades are unsavory. Some offer safe havens in troubled neighborhoods for children who lack love and support. Many arcade owners and managers pride themselves on keeping kids off the streets. A delicatessen owner with video games boasts, "I babysat a bunch of kids here all summer. It may have cost them money, but they were here, they were safe, and they didn't get into trouble." Another arcade manager's message is more telling: "There isn't a single kid who leaves here with enough money to go out and buy dope."

Skills. Many of the benefits of video games are sophisticated and constructive. Some psychologists say the video game experience improves eye-hand coordination, decision making skills, and reflexes. It is believed that focusing on a screen full of moving objects turns players into faster readers and better drivers. To play these games, many players develop new mental and visual skills. MIT sociologist Sherry Turkle says, "I think they are learning a lot of spatial thinking, a lot of geometrical thinking."

Learning. Educators are perhaps those most convinced of the merits of video games. Many teachers think that the games help average kids develop better fundamental academic skills and give them more confidence in their ability to master complex learning situations. Psychologist Roger Gable believes that the games are pioneering a new form of learning much more suited to the emerging computer based society than the linear education now available in schools and books. "The arcade machines," he explains, "are skillful teachers with more variety and individuality than many human teachers."

Moreover, most teachers feel that video games shield youths from future technological shock. The games show children that they shouldn't be intimidated or afraid of computers—that computers can be fun.

Therapy. The inroads that video games have made in therapy are fascinating. Because of the immediate feedback and instant gratification of the games, they have been extremely useful in reaching retarded and emotionally disturbed individuals. They have also been used to develop coordination in brain injured patients and to treat "lazy eye" successfully. The Epilepsy Center at Johns Hopkins University Medical School uses three specially wired Atari units to detect the effects of anti-convulsive drugs on learning and ability. Because the games induce children to be eager to do their best in eye-hand coordination tests, the units have been particularly successful.

Testing and training. The United States Army, Navy, and Air Force have been independently using and developing video games for performance testing and training. Dr. Thomas Longridge of the Air Force noticed that the rapid information processing skills required of video game players were quite similar to those used by fighter pilots who had video displays in their cockpits. He uses an aircraft carrier landing game for research on pilot judgment. Army General Donn Starry, who uses a version of Atari's Battlezone for training needs, noticed similar learning processes. "I see a lot of people in those arcades learning something, and they are all volunteers, and they are paying a quarter to learn whatever it is they learn from these machines," he observed.

Focusing on a screen full of moving objects turns players into faster readers.

Atari worked with Starry to revise Battlezone, a shooting game that targets realistic silhouettes of enemy tanks and helicopters, for training purposes. The Army's attraction to video games was also based on its desire to have a subtler training device.

Legislation

Apparently the detractors of video games have outvoiced the supporters; changes have been enacted. The money drain on children's allowances is the major reason that Babylon, NY; Oakland, CA; Pembroke Pines, FL; and Durham, NC have cited as they passed ordinances restricting play by teenagers. Many other towns have banned arcades, limited the number of video game machines, declared moratoriums on the processing of permit applications or closed campuses to the games. The U.S. Supreme Court ruling on a Texas ordinance forbidding play by youths under the age of 17 is still pending.

Chicago Alderman Patrick Huels has offered legislation that seems a bit less reactionary and more sensible than the actions of many communities. Besides banning anyone under 18 from playing video games, it would change the zoning requirements of arcades. In Chicago, only establishments with *six or more* machines must meet the zoning requirements: Arcades cannot be in a residential zone and must be more than 200 feet from a church or school. Under his proposal, anyone with at least *one* machine would have to meet these, in addition to health and safety requirements.

A small coalition that has spoken out against restrictive legislation raises an interesting argument: Much of the legislation is aimed only at young people gathering in groups. The coalition asserts that parents should raise their children well and that parental legislation rather than government legislation is needed.

Conclusion

Video games obviously fulfill personal and social needs that are unmet by other diversions. Parents who are frightened of losing touch with their kids may blame video games rather than cope with their children's need for independence. Reactionary legislation is selfishly and single-mindedly usurping the fun to which we are all entitled. It is amazing that something so thrilling and productively challenging can be viewed as a threat; the whole business may become "Reefer Madness" revisited. END

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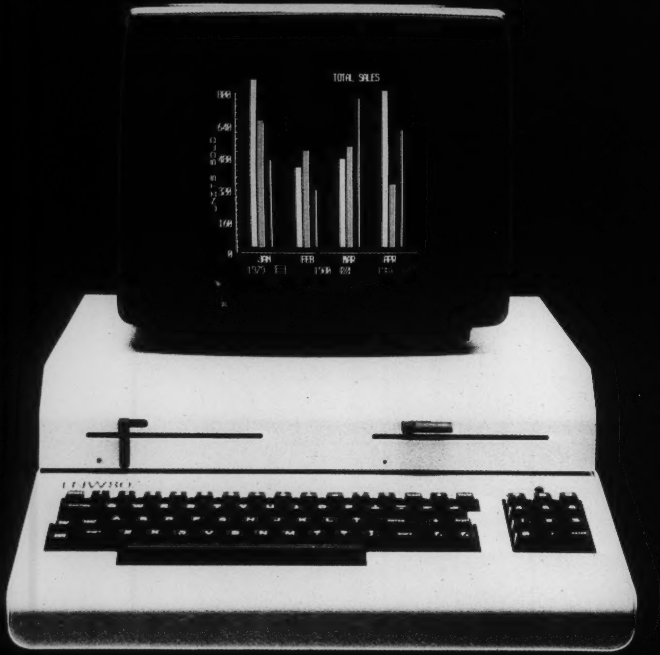

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LNW COMPUTERS

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Tired of business graphs? Here are some techniques and four short programs for doing "string art" on any plotter.

PLOTTER TUTORIAL

Part 1

David H. Ahl

Did you get a plotter to make bar charts for business reports? Or are you using a plotter for architectural drawings? Or did you decide it would just make a nice addition to your computer system?

No matter what your reason for getting a plotter, at some point you will want to use it as an artistic tool. In this series of tutorials, we will look at the basic principles of plotting as we work our way toward doing some wild and wonderful drawings.

Mathematics—The Basis of Plotting

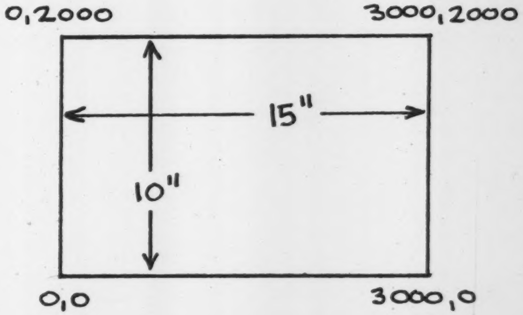
Plotting is not a free-form process. A graphics entry tablet is an electronic analog to a canvas, paint, and brushes. On the other hand, a plotter is analogous to a mechanical drawing table, ink, and drafting instruments—but not quite, as everything must be defined in mathematical coordinates before a plotter can do its job.

The mathematics for plotting need not be intimidating. All that is needed is arithmetic, simple geometry, and sometimes a bit of algebra. Indeed, most modern plotters take care of a great deal of the mathematics internally.

Our Plotter—And Yours

For this first tutorial, we have chosen to use a Houston Instrument DMP-29 plotter so our scaling and commands will correspond to that unit. However, everything in this article can be applied to any plotter—Strobe, Mannesmann Tally, Hewlett Packard, et al.

Figure 1. Plotter coordinates on DMP-29 plotter.



The DMP-29 plotter can plot in increments (step sizes) of 0.001", 0.005", and 0.1 mm. We chose to use the largest step size (0.005"). This means that there are 200 steps per inch and that the maximum plotting dimensions of 10" x 15" correspond to 2000 steps and 3000 steps. Thus, our active plotting area has x,y coordinates 0,0 in the lower left and 3000,2000 in the upper right (see Figure 1). You should prepare a similar diagram for your plotter.

The DMP-29 plotter is linked to a computer via the RS-232 port. Our programs refer to the plotter as device 1, so all plotter commands are sent using a statement such as:

PRINT #1, "Stuff to plotter"

For example, to draw a border around the outside of the paper, we would give the command:

PRINT #1,"0,0 3000,0 3000,2000 0,2000 0,0"

Values in each pair of x,y points are separated by a comma, while pairs of points are separated by a space. Determine how this is done on your plotter, and draw a border around the edge of a sheet of paper.

Lines In A Circle

A plot that plotter manufacturers often use to show off their plotters at a show—don't ask us why—is a circle with lines connecting points on the circumference. A circle can be divided into any reasonable number of increments. We chose 16 points to start.

We arbitrarily numbered the 16 points on the circumference starting at zero degrees and proceeding counter clockwise. To use these points in a plot, we need to know the x and y value of each one. From algebra, we know that the equation describing a circle is $x^2+y^2=r^2$. However, that isn't a great deal of help. Much more useful in this case is remembering that angular points can be defined with the sine and cosine functions.

Thus if we want the x and y value of point 3, we must know the angle between points 1 and 3 (45 degrees). Then, the x value of point 3 is the sine of 45 (0.7071) and the y value is the cosine of 45. These values are for a circle of radius 1 and must be multiplied by the appropriate scaling factor. We multiplied by 800 so our final plot would be 1600 units (8") in diameter.

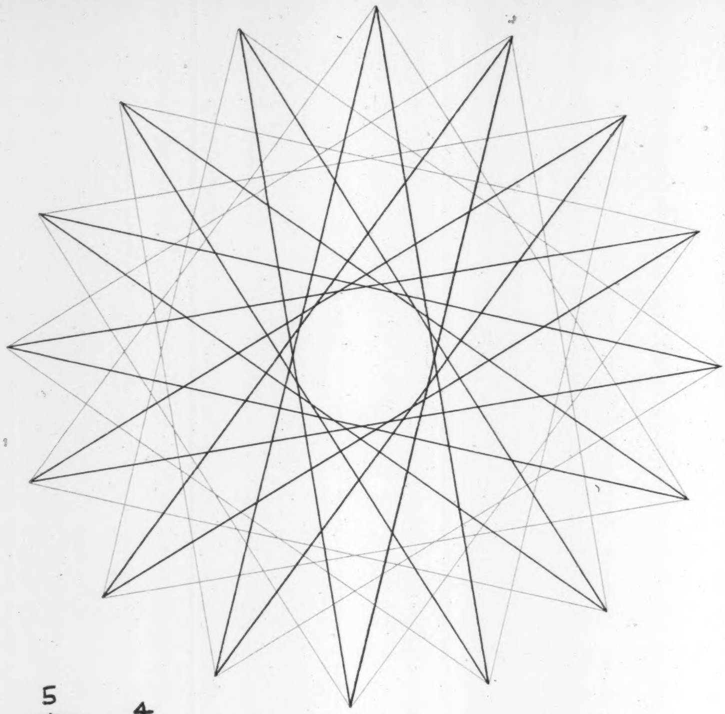


Figure 3. Finished lines in circle plot.

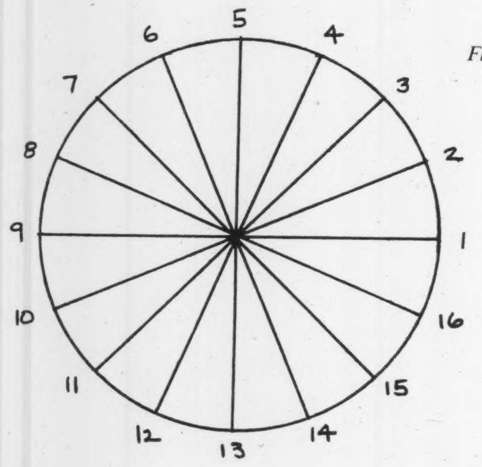


Figure 2. Circle is divided into 16 pieces.

Listing 1. Program listing for lines in circle plot.

```
10 CLS:INPUT "Plotter ready";Y$
20 IF Y$="Y" OR Y$="y" THEN 30 ELSE 10
30 OPEN "COM:6N82XN" FOR OUTPUT AS 1
40 PRINT #1,"Z ;: A"
50 DIM X(20),Y(20)
60 C=3.14159/8
70 FOR I=1 TO 16
80 A=C*I
90 X(I)=INT(800*SIN(A)+1600)
100 Y(I)=INT(800*COS(A)+1000)
110 NEXT I
120 FOR P=1 TO 2
130 PRINT #1,X(1),Y(1)"D"
140 FOR N=1 TO 17
150 READ I
160 PRINT #1,X(I),Y(I)
170 NEXT N
180 PRINT #1,"U P2"
190 NEXT P
200 PRINT #1,"H"
210 DATA 1,10,3,12,5,14,7,16,9,2,11,4,13,6,15,8,1
220 DATA 1,12,7,2,13,8,3,14,9,4,15,10,5,16,11,6,1
```

These values also assume that the origin (0,0) is at the center of the plot. Since this is generally not the case, you must add appropriate x and y distances from the plotter origin at the lower left. We added 1600 to our x values and 1000 to our y values.

The Basic on most computers requires the angular arguments of trig functions (sine, cosine, tangent) to be expressed in radians. We made this conversion in lines 60 and 80 (see Listing 1).

The 16 points on the circumference are defined in lines 90 and 100. From line 120 on is the plot routine to connect selected pairs of points.

Note that we defined the point pairs to be connected in the two data statements (210, 220) rather than coming up with a mathematical progression to define the point pairs.

This part of the program could be simpler, but we wanted a two-color plot. Line 130 moves the first pen to the first x,y coordinate. The loop from line 140 to 170 reads successive points from the data statements and instructs the plotter to draw a line between pairs of them. Line 180 raises the first pen and gets the second one, after which the loop is repeated with the second 16 pairs of points. Line 200 instructs the pen to go to the "home" position (0,0).

The final plot is shown in Figure 3.

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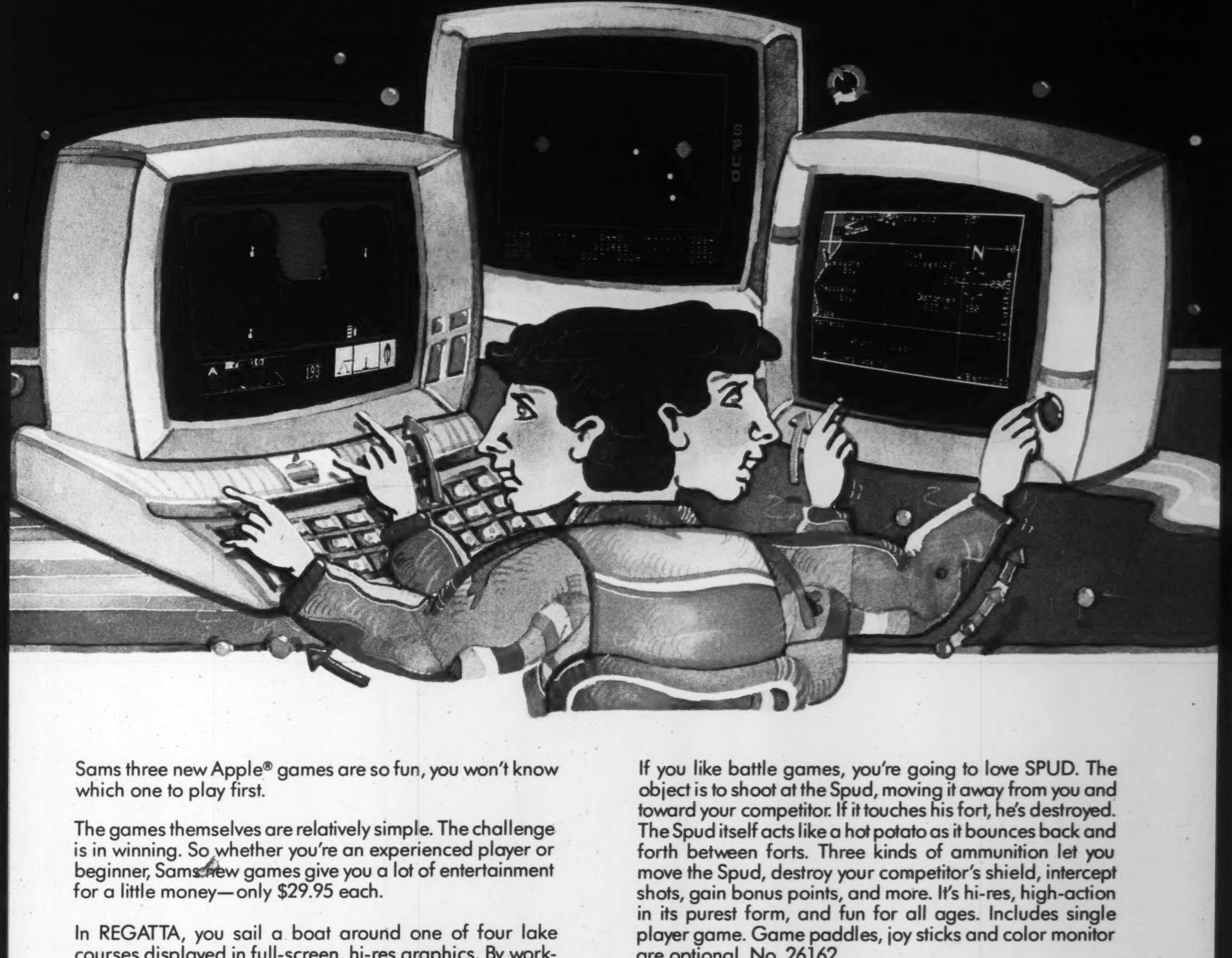

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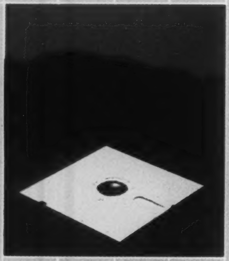

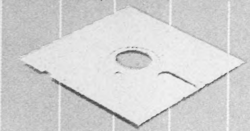

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Figure 4. Coordinates for the Orbiter plot.

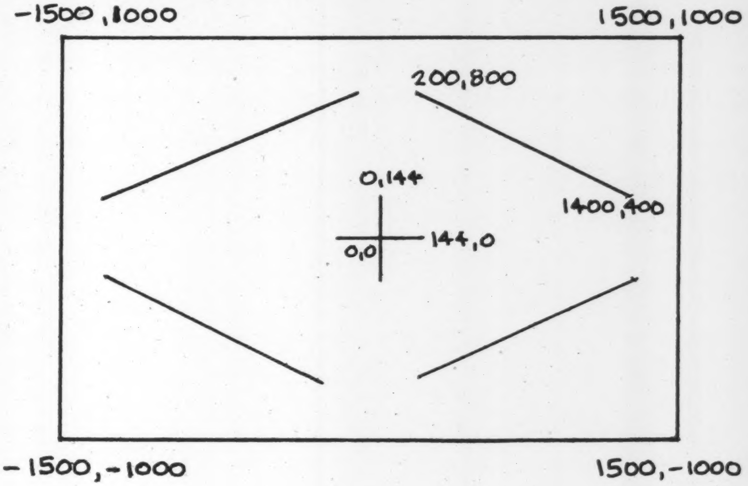
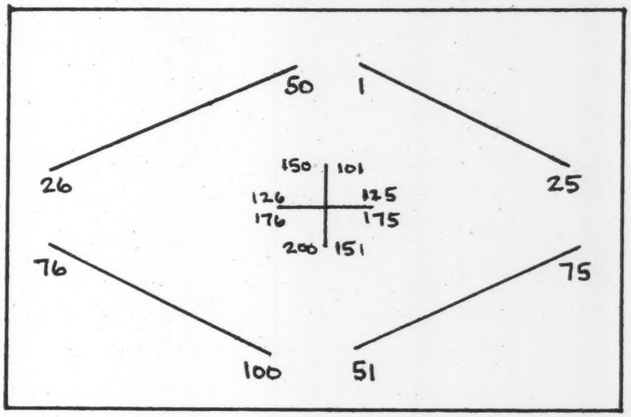


Figure 5. Index values of line segments of Orbiter plot.



The Orbiter

For our next plot, we turned to a book of string art patterns, *Pictures With Pins*. The book was published by Arco in 1978 and it has been on the remainder shelves for the past few years. No author is credited.

We did not copy any patterns exactly from the book. Rather, we used them as a basis for similar designs which lent themselves to the plotter.

The most difficult thing about any plot is defining the points. Doing that is generally far more time-consuming and takes more lines in the program than actually drawing the plot. In that regard, the Orbiter plot was no exception.

If parts of a plot are reflected or mirror images of another part, a great deal of time can be saved by defining one section and transposing or reflecting it into another quadrant. That is what we did with the Orbiter plot.

All two-dimensional straight lines can be defined with the equation $y=ax+b$. In the Orbiter plot, we wanted a slanted line in each quadrant. Because of the symmetry of this plot, we decided to take advantage of the capability of the plotter to redefine the origin any place on the plotting surface. We put it in the center (1500,1000). We then decided our slanted line should go from $x=200$, $y=800$ to $x=1400$, $y=400$ (see Figure 4). This led to an equation of $y=-x/3+867$.

We also decided that the points in the center cross should go from 0,0 to 0,144 and from 0,0 to 144,0. We arbitrarily decided to have 25 points along each line segment and assigned index values to all the points (see Figure 5).

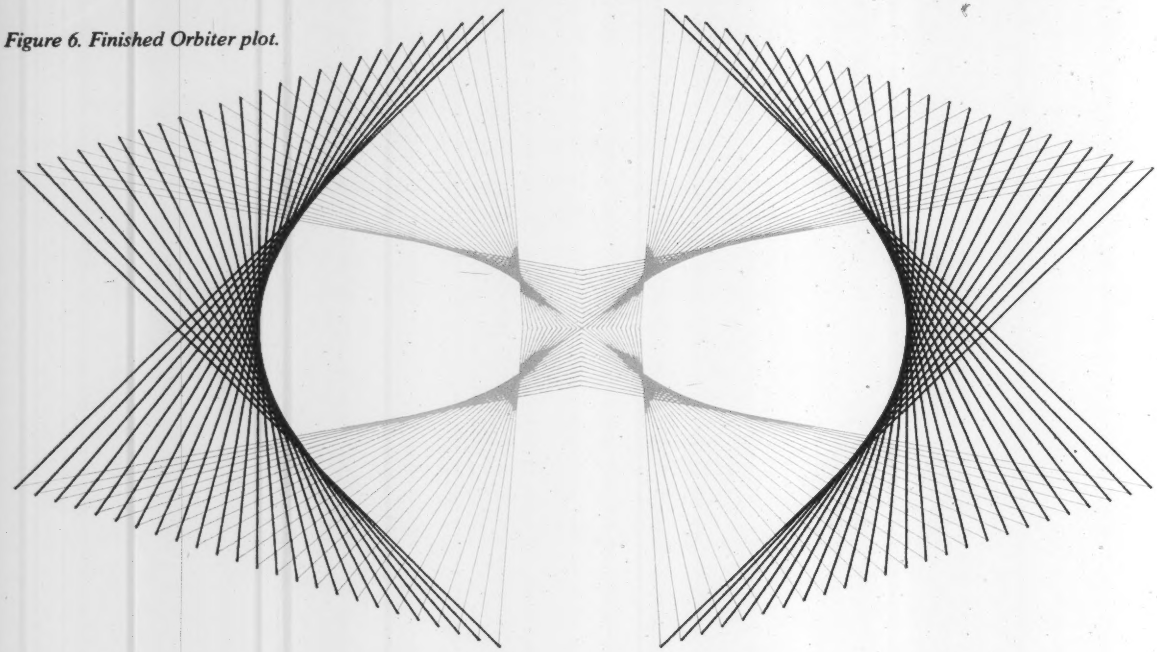
Now for the tedious part—writing the program (see Listing 2). First, each x,y point pair in the initial slanted line was defined (lines 80 and 90) and all of the transposed and mirror image point pairs were assigned values (lines 100 and 110).

Then all of the point pairs in the center cross were assigned values in lines 140 to 190. These were assigned in groups of 13 since the line makes a right angle at the center.

Listing 2. Program listing for Orbiter plot.

```
10 CLS:PRINT "Orbiter Plot"
20 INPUT "Plotter ready";Y$
30 IF Y$="y" OR Y$="Y" THEN 40 ELSE 20
40 OPEN "COM:6N82XN" FOR OUTPUT AS 1
50 PRINT #1,"Z ;:A 1600,1000 O"
60 DEFINT X,Y,I:DIM X(200),Y(200)
70 FOR I=1 TO 25
80 X(I)=150+50*I
90 Y(I)=INT(867-X(I)/3)
100 X(25+I)=-X(I):X(50+I)=X(I):X(75+I)=-X(I)
110 Y(25+I)=Y(I):Y(50+I)=-Y(I):Y(75+I)=-Y(I)
120 NEXT I
130 FOR I=1 TO 13
140 X(100+I)=156-12*I:Y(100+I)=0
150 X(125+I)=-X(100+I):X(150+I)=X(100+I):X(175+I)=-X(100+I)
160 Y(125+I)=0:Y(150+I)=0:Y(175+I)=0
170 X(126-I)=0:X(151-I)=0:X(176-I)=0:X(201-I)=0
180 Y(126-I)=X(100+I):Y(151-I)=Y(126-I)
190 Y(176-I)=-Y(126-I):Y(201-I)=-Y(126-I)
200 NEXT I
210 GOTO 250
220 FOR I=1 TO 100
230 PRINT #1,X(I),Y(I) "D" X(100+I),Y(100+I) "U"
240 NEXT I
250 PRINT #1,"P2"
260 FOR I=1 TO 25
270 PRINT #1,X(I),Y(I) "D" X(76-I),Y(76-I) "U"
280 NEXT I
290 FOR I=26 TO 50
300 PRINT #1,X(I),Y(I) "D" X(126-I),Y(126-I) "U"
310 NEXT I
320 PRINT #1,"P0"
```

Figure 6. Finished Orbiter plot.



Since we chose our index values reasonably cleverly (points to be connected are in pairs such as 32, 132 and 84, 184), it was a simple matter to write the part of the program that draws the plot. The main plot is drawn in lines 220 to 240.

Line 250 gets a second color pen, and the two outside portions of the Orbiter are joined in the loops at lines 260 to 280 and 290 to 310. The final Orbiter is shown in Figure 6.

Tornado Plot

The Tornado was also inspired by *Pictures With Pins*. In contrast to the Orbiter, this plot uses all curved surfaces, eight quarter circles to be exact.

Initially, we attempted to define just the points in one quarter of a circle and transpose them to the other seven locations. It probably could be made to work; however, four of the quarter circles kept coming out as either straight lines or with reversed curvature. Hence, we finally gave up and defined the points in an entire circle (lines 70 to 110) and then selected whichever quadrant was required (lines 120 to 210).

Listing 3. Program listing for Tornado plot.

```
100 CLS:PRINT "Tornado Plot by David Ahl"
110 INPUT "Plotter ready";Y$
120 IF Y$="Y" OR Y$="y" THEN 130 ELSE 110
130 OPEN "COM:6N82XN" FOR OUTPUT AS 1
140 DIM X(73),Y(73),EX(73),EY(73),FX(73),FY(73),GX(73),GY(73),HX(73),HY(73)
150 C=3.14159/72:R=375
160 REM *** Calculate points in base circle ***
170 FOR I=1 TO 73:
180 A=C*(I-1)
190 Y(I)=INT(R*SIN(A))
200 X(I)=INT(R*COS(A))
210 NEXT I
220 REM *** Point positions in quarter circles ***
230 FOR I=1 TO 37
240 EX(I)=X(I):EY(I)=Y(I)
250 FX(I)=X(74-I)+1500:FY(I)=Y(I)
260 GX(I)=X(I)+1500:GY(I)=Y(I)
270 HX(I)=X(74-I)+3000:HY(I)=Y(I)
280 EX(74-I)=EX(I):EY(74-I)=750-EY(I)
290 FX(74-I)=FX(I):FY(74-I)=750-FY(I)
300 GX(74-I)=GX(I):GY(74-I)=750-GY(I)
310 HX(74-I)=HX(I):HY(74-I)=750-HY(I)
320 NEXT I
330 REM *** Pen 1 to first point to be plotted ***
340 PRINT #1,";: V4 A 375,0 D"
350 FOR I=1 TO 73
360 PRINT #1,EX(I),EY(I) "D" GX(74-I),GY(74-I) "U"
370 NEXT I
380 FOR I=1 TO 73
390 PRINT #1,FX(74-I),FY(74-I) "D" HX(I),HY(I) "U"
400 NEXT I
410 REM *** Pen 2 to start of second color ***
420 PRINT #1,"U P2 375,0 D"
430 FOR I=1 TO 73
440 PRINT #1,EX(I),EY(I) "D" FX(74-I),FY(74-I) "U"
450 NEXT I
460 FOR I=1 TO 73
470 PRINT #1,GX(74-I),GY(74-I) "D" HX(I),HY(I) "U"
480 NEXT I
490 PRINT #1,"PO"
500 PRINT "Plot finished.":END
```

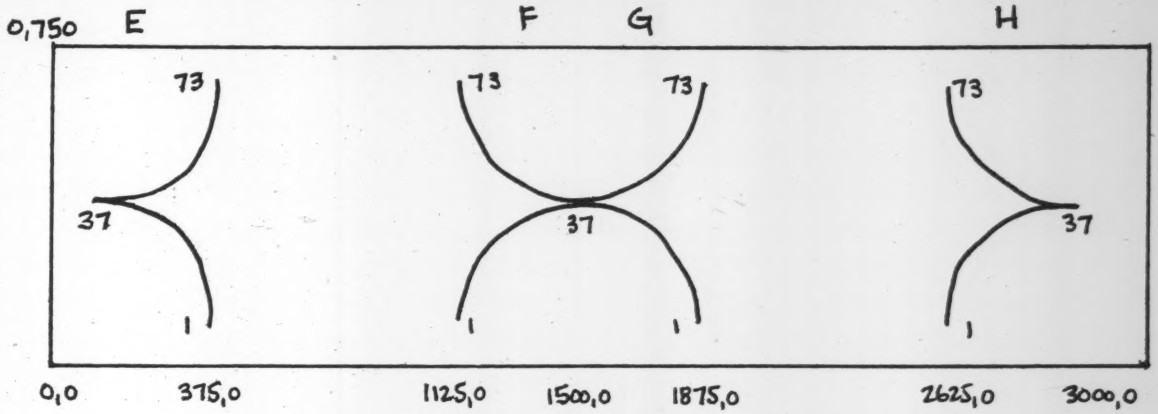


Figure 7. Coordinates and index values for the Tornado plot.

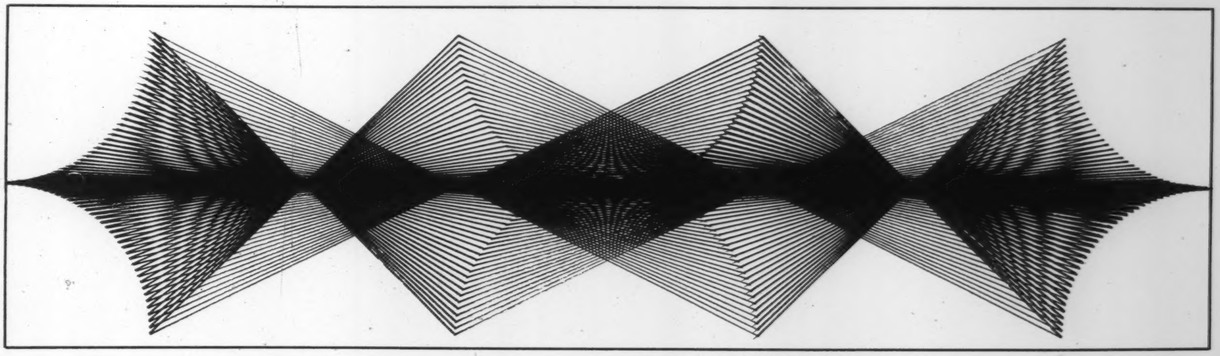


Figure 8. Finished Tornado plot.

However, we are getting ahead of ourselves. In the Tornado, as with every plot, the first thing is to sketch out the points first and assign index values to all the point pairs (see Figure 7). We decided that each quarter circle was to be divided into 36 segments and that the radius of each one should be 375 units. Around the outside of the diagram, we noted nine of the coordinate pair values.

As with most plot programs, the tedious part is setting the values of all the point pairs. As mentioned above, this is done in Lines 120 to 210. We divided the plot into four horizontal areas, E,F,G, and H. Within each area are 73 point pairs.

The Tornado plot has two major plotting routines. The first draws the longer lines with one color between segments E and G, and F and H. The second draws the shorter lines between E and F, and G and H. The finished plot is shown in Figure 8.

Interconnected Hyperbolas

The last plot is an original one done with all straight lines, but which give the illusion of being curved. Again, we are working with a plot with maximum coordinates of 3000,2000. Index values of the coordinate point pairs are shown in Figure 9.

In this figure, the equation of one diagonal line must be defined. We wanted it to run from x=75, y=75 to x=2925, y=1925, so the equation of the line was y=.649x+26.325. Note the use of this equation in line 210 of Listing 4.

The values of the outside rectangle are assigned in lines 170 to 200, while the reflected and transposed images of the diagonal line are set in lines 210 to 240.

Figure 9. Index values of line segments for Interconnected Hyperbolas plot.

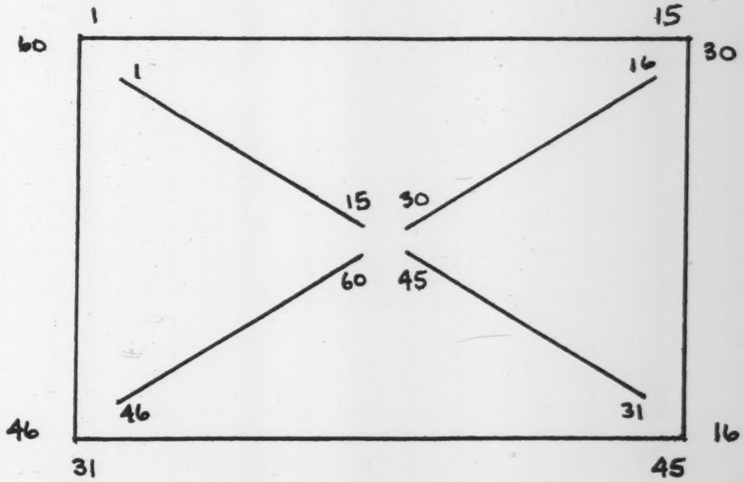
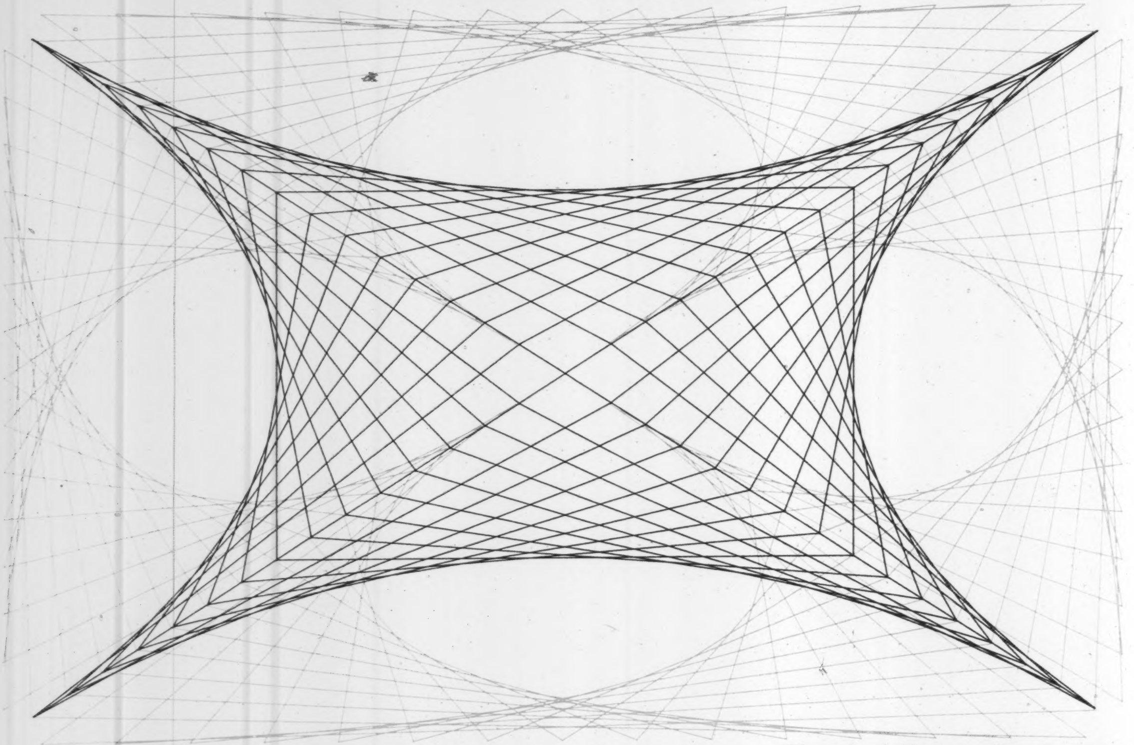


Figure 10. Finished Interconnected Hyperbolas plot.



Listing 4. Program listing for Interconnected Hyperbolas plot.

```
100 CLS:PRINT "Rectangular hyperbolic plot by D. Ahl"
110 INPUT "Plotter ready";Y$
120 IF Y$="Y" OR Y$="y" THEN 130 ELSE 110
130 OPEN "COM:6N82XN" FOR OUTPUT AS 1
140 DIM AX(60),AY(60),BX(60),BY(60)
150 REM *** Set rectangle values ***
160 FOR I=1 TO 15
170 AX(I)=200*I-100:AY(I)=2000
180 AX(30+I)=AX(I):AY(30+I)=0
190 AX(15+I)=3000:AY(15+I)=129*I-32
200 AX(45+I)=0:AY(45+I)=AY(15+I)
210 BX(I)=93*I-18:BY(45+I)=INT(.649*BX(I)+26.325)
220 BX(45+I)=BX(I):BY(I)=2000-BY(45+I)
230 BX(15+I)=3000-BX(I):BY(15+I)=BY(I)
240 BX(30+I)=BX(15+I):BY(30+I)=BY(45+I)
250 NEXT I
260 REM *** Initialize first pen ***
270 PRINT #1,";: V4 A 100,2000 D"
280 FOR I=1 TO 15
290 T1=15+I:T2=30+I:T3=45+I:T4=61-I
300 PRINT #1,AX(I),AY(I) "D" BX(16-I),BY(16-I) "U"
310 PRINT #1,AX(I),AY(I) "D" BX(T1),BY(T1) "U"
320 PRINT #1,AX(T1),AY(T1) "D" BX(T1),BY(T1) "U"
330 PRINT #1,AX(T1),AY(T1) "D" BX(46-I),BY(46-I) "U"
340 PRINT #1,AX(T2),AY(T2) "D" BX(T2),BY(T2) "U"
350 PRINT #1,AX(T2),AY(T2) "D" BX(T4),BY(T4) "U"
360 PRINT #1,AX(T3),AY(T3) "D" BX(I),BY(I) "U"
370 PRINT #1,AX(T3),AY(T3) "D" BX(T4),BY(T4) "U"
380 NEXT I
390 REM *** Get second pen ***
400 PRINT #1,"U P2"
410 FOR I=1 TO 15
420 PRINT #1,BX(I),BY(I) "D" BX(31-I),BY(31-I) "U"
430 PRINT #1,BX(15+I),BY(15+I) "D" BX(46-I),BY(46-I) "U"
440 PRINT #1,BX(30+I),BY(30+I) "D" BX(61-I),BY(61-I) "U"
450 PRINT #1,BX(45+I),BY(45+I) "D" BX(16-I),BY(16-I) "U"
460 NEXT I
470 PRINT #1,BX(1),BY(1) "D" BX(31),BY(31) "U"
480 PRINT #1,BX(16),BY(16) "D" BX(46),BY(46) "U"
490 PRINT #1,"P0":END
```

There is nothing complex about any of these routines to set the values of point pairs except that you must keep track of the index values.

Since we did not assign the point index values very cleverly in this program, many more program lines were required to define plotter movement than in the previous programs. Of course, part of this is because there are more segments to be connected (each border point is connected to two others, and each diagonal point is connected to four others).

Program lines to instruct the plotter to draw the center portion of the plot are found in the loop from lines 410 to 460. The final program lines (470, 480) connect the four center points in an X, and line 490 instructs the pen to return to the origin. The final plot is shown in Figure 10.

Let Us See Your Plots

For future installments of this tutorial series, we would like to include reader submissions as well as our material. When sending a plot, please include a program listing (dark ribbon, single spaced), a clear description of how it was produced along with any mathematics required (typed, double spaced), and any supplemental diagrams.

Next installment: spirals and the random factor. END

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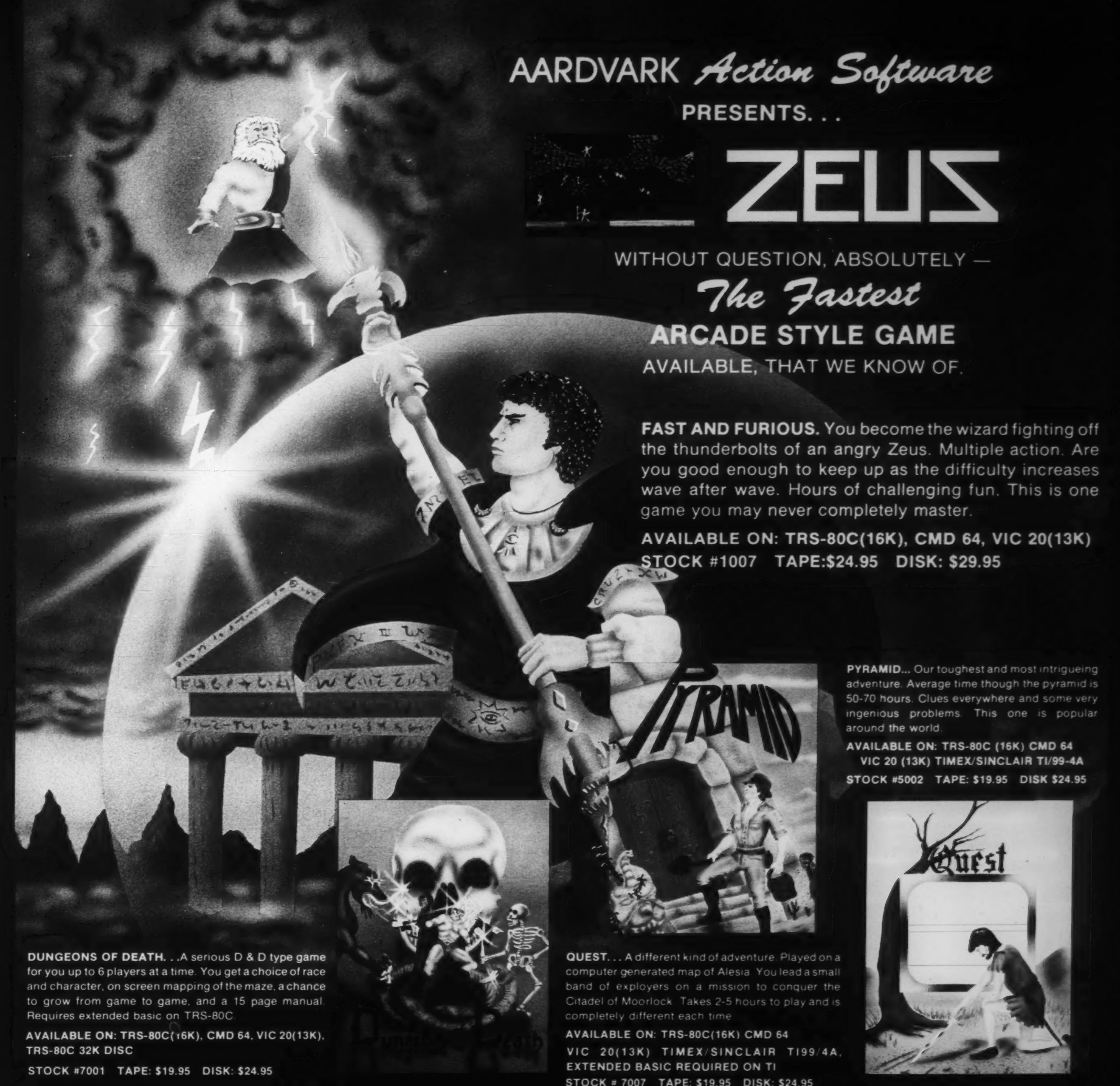

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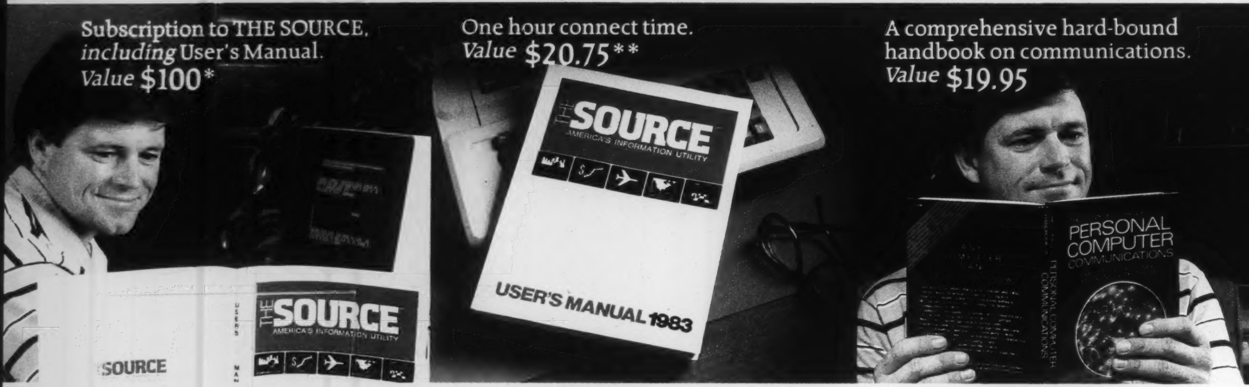
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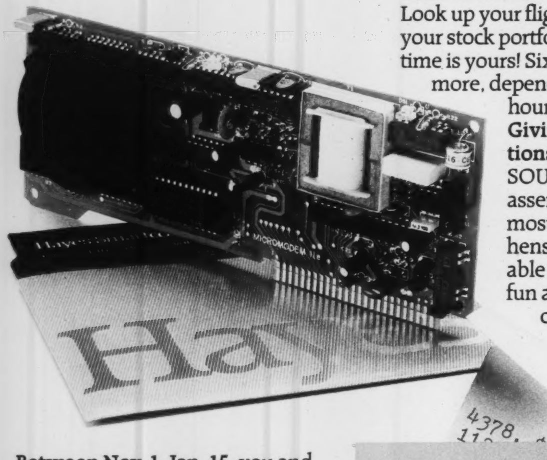

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The Poor Man's Programmable Key

Pat Macaluso

I recently wrote a program of some 300 lines in Microsoft Basic—on paper, of course. I was then faced with the boring prospect of entering all those lines. Worse still, I was risking an attack of key stroke, a malady which affects the forefinger of hunt-and-peck typists like myself.

An obvious solution was to use one of many available programmable-key programs. These allow the substitution of a single key for a word or expression. An example might be the use of SHIFT-R in place of typing in the word RETURN, SHIFT-G for GOSUB and so on.

This simple utility is an example of a self-modifying program.

The problem with that was that I wanted to enter the program in pieces that I could test and save frequently. I also wanted to avoid the extra loading of a utility program each time I turned the computer on. A good solution would be to integrate a very short utility into my program—at least until the program was fully entered.

An examination of the program I had written showed it to contain many GOSUBS, RETURNS, IFS, and THENS. IF was too small a fish to bother with so I threw it back into the typing pool. Next I looked for three characters not used in the program. The symbols %, &, and ! qualified. The short Basic program shown in Listing 1 was the result. The program to be entered uses line numbers below 63999.

Using The Programmed Keys

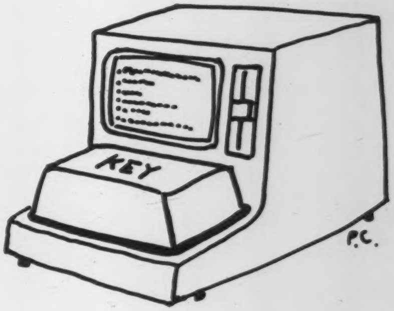
Suppose you want to enter:

```
100 IF ST = "Y" THEN
 GOSUB2000:RETURN
```

You would simply type:

```
100 IF ST = "Y" !%2000:&
```

thereby saving 12 key strokes. When you have entered a decent number of lines and are ready to do some testing or saving, type RUN64000. The routine goes through the lines at about one line per second, converting them to their final form.



This sequence of enter, convert, test, and save is continued until the entire program is entered. The lines from 63999 and up can then be deleted.

How It Works

This simple utility is an example of a self-modifying program. This is not a desirable practice in large or complex programs. In a simple case like this,

Listing 1. Example for three programmed keys.

```
63999 END:TROFF
64000 '==CONVERT !%& TO THEN, GOSUB, RETURN==
64010 CLS:NL=PEEK(16548)+256*PEEK(16549):K=0:PRINT@0,"     "
64020 FOR I=NL+4 TO NL+999:CD=PEEK(I)
64030 IF CD=151 THEN END
64040 IF CD=0 THEN K=K+1:PRINT@0,K:GOTO64090
64050 IF CD=37 THEN POKE I,145
64060 IF CD=38 THEN POKE I,146
64070 IF CD=33 THEN POKE I,202
64080 NEXTI
64090 NL=I+1:GOTO64020
```

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Poor Man's Key, continued...

```
64100 NL=PEEK(16548)+256*PEEK(16549):GOTO64120
64110 INPUT NL:CLS
64120 FOR I=1 TO 15:J=PEEK(NL+I)
64130 IF J<32 OR J>191 THEN J=32
64140 PRINT NL+I,PEEK(NL+I),CHR$(J)
64150 NEXTI:GOTO64110
```

Listing 2. Program to display stored Basic source code.

however, there is little danger of confusion, and it offers considerable convenience.

In this case it trades on three neat features of Microsoft Basic. First, the Basic program lines (source code) are always stored in succession in a memory area with a fixed starting address. In the case of the TRS-80 Model I and Model III, this address is stored at a location whose decimal address is 16548 and 16549.

Second, each Basic program line has a fixed structure. It is quite simple. Bytes 1 through 4 form a header with the address of the next line in bytes 1 and 2. The current line number is in bytes 3 and 4. The end of the line is marked by a byte with an ASCII code of zero. All the intervening bytes consist of the ASCII codes for your program. ASCII codes are listed in most manuals on Microsoft Basic.

The third feature is the use of *tokens* to represent Basic language keywords. Thus the word GOSUB is stored not as five characters but as a single character whose ASCII code is 145. This turns out to be a TRS-80 graphics character. That is quite all right since the interpreter knows you can't use graphic codes in a Basic program except in literals (quotes) or in character strings.

Line 63999 contains an END to keep the main program from accidentally running into the 64000 block. TROFF (trace off) is simply a convenient way of detecting the end of your Basic program. The token code for it is 151. The utility simply loops through the lines, by-passing the headers and looking for TROFF, 0, !% or &. It exits when 151 is encountered. It starts the next iteration on 0 and substitutes the correct tokens for the selected special characters. That is all there is to it.

If you want to check what is going on for yourself, add the lines shown in Listing 2. RUN 64100 will allow you to examine any part of memory after an initial look at line 1.

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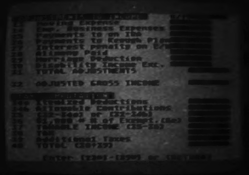

5

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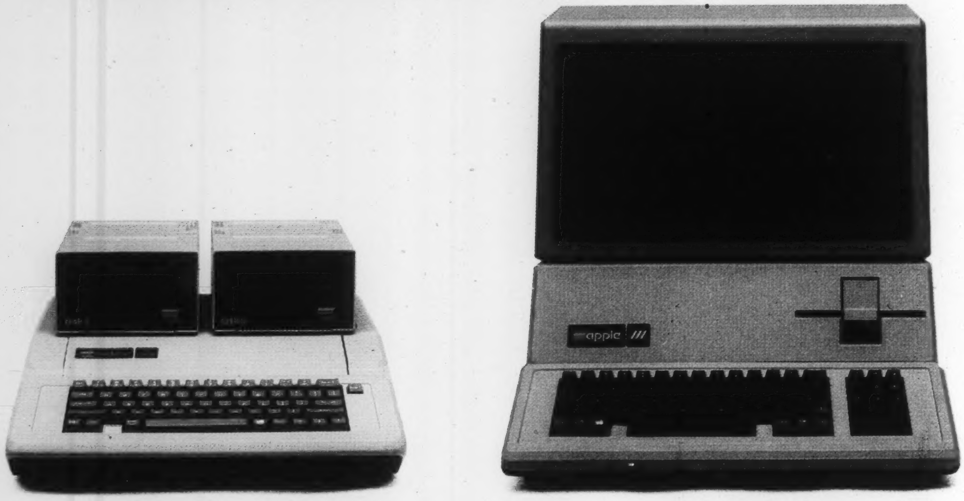

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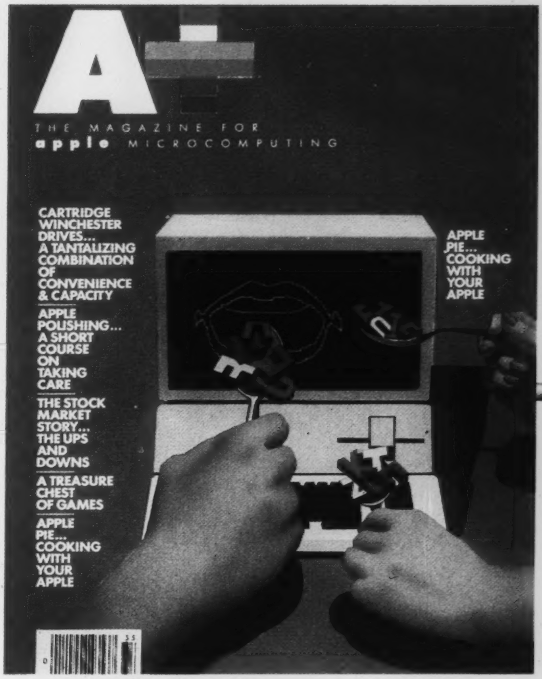
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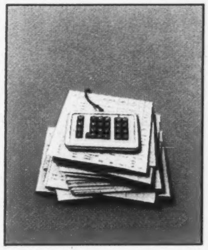

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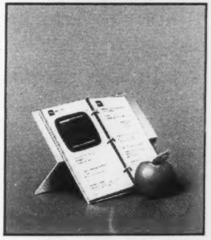

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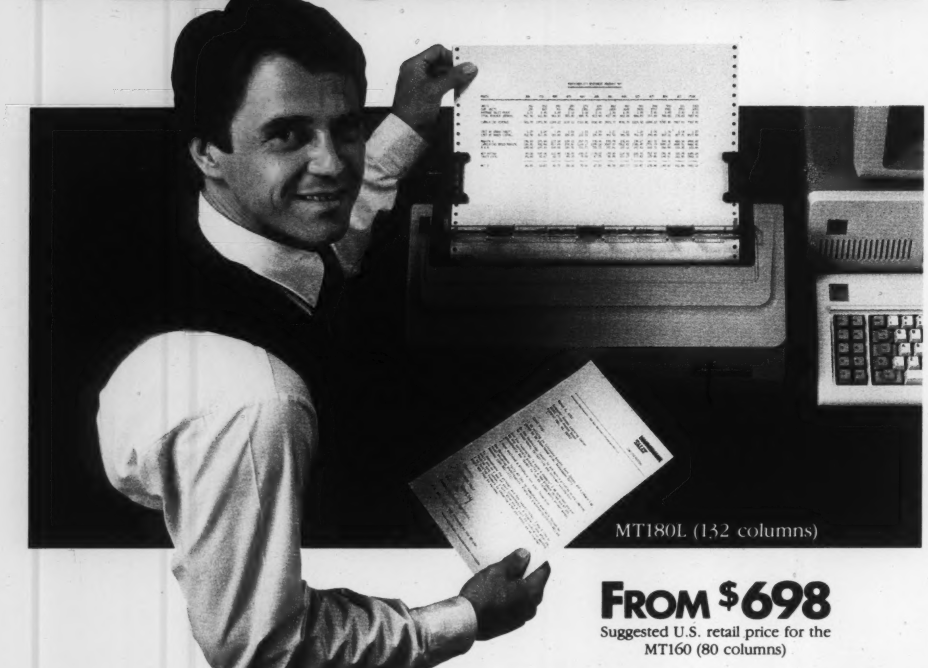

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Absolutely Bombproof Input Routine

Chris Glenn

Like the search for an honest man, the search for a truly user-proof INPUT routine never seems to end. Greg Kielian's attempt (*Creative Computing,* November 1980) was noble, but erases characters from the INPUT line when the back arrow is used. Susan Luca solved that problem (*Creative Computing,* May 1981), but her routine was tailored specifically for her own needs.

Absolutely Bombproof Input is constructed for more general applications, and is absolutely positively bombproof (except, alas, for our old nemesis RESET). Any alphanumeric or special character is permitted, including] (SHIFT-M), but control characters are rejected. The forward and back arrow keys are fully functional and can be used to move anywhere on the INPUT line without affecting characters on the screen. The routine is very fast, so lag time between the keystroke and printing to the screen is insignificant.

Another feature lets the programmer choose the maximum length of the INPUT line and place it anywhere on the screen by assigning variables L, H, and V (Length, Horizontal position, Vertical position) to suit. Should the INPUT length reach the specified maximum while the routine is in use, the cursor simply sits and beeps until a back arrow or RETURN, signifying end of INPUT, is pressed.

The Main Program: Musts And Limits

Lines 0-120 of the listing constitute the trivial main program for this demonstration, but contain significant features which *must* be included in any main program with which the Absolutely Bombproof Input routine is used.

It is up to the programmer, as in line 20 of the demo, to dimension the two string arrays, C$ and TC$, used by the routine to assemble the INPUT. And the main program must also set values for the aforementioned programmer-controlled L, H, and V variables, as in line 30 of the demo.

Be reasonable; you obviously can't set V = 23 if L = 200; there aren't enough rows left on the screen for all those characters. Nor can you, under any circumstances, set L and H so that their sum is greater than 254 or you will be asking the routine to exceed the maximum string length of Applesoft. Either way, Absolutely Bombproof Input will bomb. Please appreciate, however, that if committed, those are *programmer*—not *user*—errors.

The Absolutely Bombproof Input Routine

The Absolutely Bombproof Input routine itself uses GETS to compartmentalize the individual characters of the INPUT line in separate string array locations. But first, line 1110 must null out any previously formed INPUT strings and arrays. Setting H1 = H in line 1120 "remembers" the original value of H, which changes as the routine proceeds. Line 1130 sets a guard against accidentally "backing out" of the alloted space for the INPUT. Line 1140 places the cursor at the beginning of the INPUT space, and advances its horizontal position as H is incremented with each successive pass through the INPUT-building loop.

At line 1150, characters are gathered one at a time with GET C$ (H) into the C$ array which eventually will be concatenated into the full INPUT statement, I$. Line 1160 looks for a RETURN, signalling all desired characters have been INPUT.

Line 1170 seeks the back arrow, and if it has been entered, sets a temporary TC$ array character to replace the C$ array variable that is being back-erased. At line 1180, a check is performed to see if the maximum allotted length for the INPUT has been reached, and if true, the bell sounds and no more characters are accepted.

Lines 1190 and 1200 are concerned with entry of forward arrows. First, 1190 checks the nature of the character in the temporary TC$ array position which may have been retrieved by a forward arrow. If it is not really a character, i.e., if it is null (""), then it is set to a true space, CHR$(32). Otherwise, separate words in the final INPUT statement might bunch up without intervening spaces. Line 1200 now can use forward arrows to copy back into the "real" C$ array any temporary TC$ array characters which may have been set previously by back arrows. The final filter takes place at line 1210, which refuses INPUT of any control character.

At last, in line 1220, the current C$ array character is accepted, and displayed in its proper position on the screen. Line 1230 increments the horizontal position counter and returns to the beginning of the loop to fetch the next character.

The routine ends at line 1240, which is reached only after a RETURN has been encountered. All the C$ array characters are now assembled into the final INPUT statement, I$, which is delivered to the main program for use as the programmer wishes.

Program Notes

Absolutely Bombproof Input was written in Applesoft on an Apple II Plus with 48K RAM, DOS 3.3, and an Integer card. The length of the routine (lines 1000-1240) is 584 bytes, including all remarks. When transcribing, I suggest you include the REMs in lines 1030-1090, since they describe what the routine requires from the main program.

I have found Absolutely Bombproof Input to be very malleable. By adding a statement or two, I have been able, for example, to make it accept only letters

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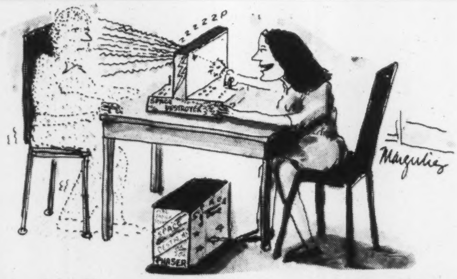
Bombproof Input, continued...

or only numbers. It could be made to demand that no spaces be in the entry, that specific combinations of characters be entered in order, or that entries be at least a certain number of characters long. My subroutine collection now includes a disk full of variations on Absolutely Bombproof Input, all of which are readily available to fill the particular needs of a program in development. END

Listing.

```
0  REM DEMONSTRATION MAIN PROGRAM
10  HOME : HTAB 3: PRINT "- ABSOLUTELY BOMBPROOF INPUT DEMO -": POKE 34,2
20  DIM C$(255),TC$(255)
30 L = 22:H = 17:V = 9
40  HOME : VTAB V: PRINT "ENTER INPUT:
50  VTAB V: HTAB H - 1: PRINT "]";: HTAB H + L + 1: PRINT  CHR$ (91)
60  GOSUB 1000: REM GET THE INPUT
70  HOME : VTAB V: PRINT "INPUT ENTERED:
80  VTAB V: HTAB H1: PRINT I$
90  VTAB V + 8: PRINT "START AGAIN? (Y/N)  ";: GET YN$
100  IF YN$ < > "Y" AND YN$ < > "N" THEN  PRINT  CHR$ (7): GOTO 90
110  IF YN$ = "Y" THEN 30
120  VTAB  PEEK (37): CALL  - 958: POKE 34,0: END
1000  REM
1010  REM   ABSOLUTELY BOMBPROOF INPUT ROUTINE
1020  REM
1030  REM   MAIN PROGRAM MUST
1040  REM   DIM C$(255),TC$(255)
1050  REM   AND SET VALUES FOR
1060  REM   L = LENGTH
1070  REM   H = HORIZ POSITION
1080  REM   V = VERT POSITION
1090  REM   BOMBS IF L + H > 254
1100  REM
1110 I$ = "": FOR X = H TO H + L:C$(X) = "":TC$(X) = "": NEXT
1120 H1 = H
1130  IF H = H1 - 1 THEN H = H1
1140  VTAB V: HTAB H
1150  GET C$(H)
1160  IF C$(H) =  CHR$ (13) THEN 1240
1170  IF C$(H) =  CHR$ (8) THEN TC$(H - 1) = C$(H - 1):H = H - 1: GOTO 1130
1180  IF H = H1 + L + 1 THEN  PRINT  CHR$ (7);: GOTO 1150
1190  IF C$(H) =  CHR$ (21) AND TC$(H) = "" THEN TC$(H) =  CHR$ (32)
1200  IF C$(H) =  CHR$ (21) THEN C$(H) = TC$(H):H = H + 1: GOTO 1130
1210  IF  ASC (C$(H)) < 32 THEN 1130
1220  VTAB V: HTAB H: PRINT C$(H);
1230 H = H + 1: GOTO 1130
1240  FOR X = 1 TO H:I$ = I$ + C$(X): NEXT : RETURN
1250  REM    BY CHRIS GLENN
```



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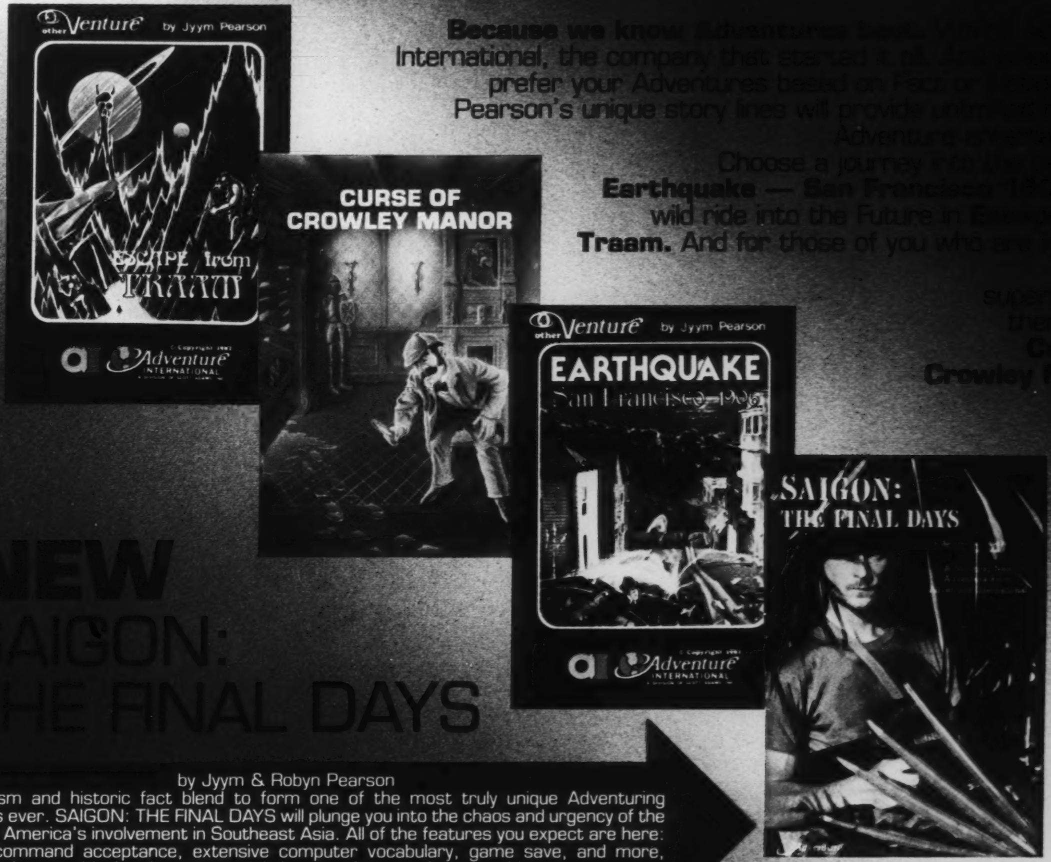

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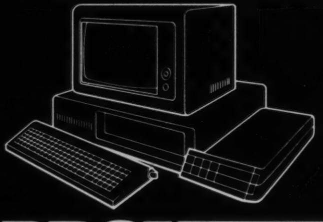

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INPUT LINE ECITORR

D

Robert J. Beck

I once wrote a program for data entry. After the umpteenth time that I typed a line like, "I ate data entry" and had to go back and retype most of the line, I began looking around for ideas.

In the November 1981 issue of *Creative Computing,* Jonathan Ashwell discusses the value of the INPUT statement and the problem of entering strings with quotation and other punctuation marks. His solution neatly retains the standard editing features and cursor moves of the Apple. These let you move the cursor back and forth, up and down, and simplify retyping and deleting when the arrow keys are used to move the cursor. These features are handy, but they don't help much with some of the more common typing errors.

Leaving a letter out, accidentally inserting an extra letter, or mixing up the order in which two letters are typed may lead to much retyping and cursor moving. After you have corrected an error in the middle of a string, you must move the cursor to the end of the line since pressing the RETURN key wipes out everything after the cursor.

I became quite intolerant of this kind of thing after using Neil Konzen's Program Line Editor to correct mistakes while writing programs. I decided to develop something that would mimic the features of Konzen's program and that could be used from within a program to ease the chores of data entry and text composition.

The Applesoft subroutine presented here (lines 10-460 of Listing 2) is based on substring manipulation and can be used in place of INPUT statements in any program. It offers extended ability to control the cursor and to insert and delete characters without retyping. An additional benefit is that any character—including commas, colons, and quotation marks—is accepted. so the subroutine can be used to enter and edit prose. It is, however, limited to inputs of fewer than 256 characters.

How It Works

Figure 1 is a flow chart of the program. Numbers in parentheses refer to line numbers in Listing 2. The stripped-down algorithm of the program goes something like this:

- GET a keystroke.
- If it is a function key such as back arrow or RETURN, perform the function.
- If it is a regular character, print the character on the screen and add it to the string, fitting it in wherever it belongs.
- Repeat this sequence.

I mentioned before that the program is based on substring manipulation. What this means is that first you break a string, or sequence of characters, into pieces (substrings) then, after removing old pieces and inserting new ones, you reassemble a new version of the string. Line 120, where characters are inserted one at a time, is a good example. M$ is separated at the cursor into two substrings: LEFT$(M$,L-1) includes everything before the cursor and MID$(M$,L) holds everything from the cursor on. Z$ is inserted between them when M$ is reassembled. The cursor is then tabbed to the correct place and the changed part of the string is reprinted. By erasing and reprinting the screen, you can see immediately what you have done.

When you program in Applesoft with the INPUT statement, you have the option of printing a prompt before the cursor. You can do the same thing with this subroutine; just put your prompt or query into the variable PR$ before calling the subroutine. You should also set T equal to the line to which the prompt should VTAB. You see, I am rather lazy, and I wanted to simplify programming the cursor movement (remember the cursor isn't moved at all by a GET command), so I chose to have the inputs take place at a fixed vertical line (see line 40).

Why does this make it easier? Because I had trouble placing the cursor where I wanted it until I realized that if I always started from the same place all I had to do was keep track of where the cursor ought to be—I use the variable L—and HTAB it there whenever I needed to.

The Real Difference

Before going any further, let's look at some specific commands:

- CONTROL-B Move cursor to beginning of string.
- CONTROL-C Set cut mode. Typing a character after hitting CONTROL-C will cut out all characters between the cursor and the next occurrence of that character. Cut mode is terminated by any other keypress.
- CONTROL-D Delete the character at the cursor position.
- CONTROL-F Set find mode. When in find mode, typing a character moves the cursor to the next location of that character in the string. Like cut mode, it can be used repeatedly and is terminated by any other keypress.
- CONTROL-I Set insert mode. Characters typed while in this mode are inserted directly before the cursor. Insert mode is cancelled by any other edit option.
- CONTROL-N Move cursor to end of string.
- CONTROL-Q Cut off string at cursor.

All control characters other than those used for editing are ignored. An interesting effect of using a GET is that it interprets the arrow keys as control characters. If you want to use them, you must write your own arrow functions into the program. I have set it up so they won't move the cursor beyond the string. Use the spacebar to insert blanks.

The completed string will be in the variable R$ (line 220) after a press of the RETURN key. A very important and time-saving difference between this subroutine and regular input is that it doesn't matter where the cursor is when you press RETURN. What you see is what you get.

Because the input takes place at a fixed vertical screen line, the size of a string is limited (in addition to the usual

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Robert J. Beck, 2101 21 Ave. South, Minneapolis, MN 55404.

Apple limitation of 255) to 38 + 40*(22-T) characters. If this length is exceeded, the string will be correctly input but the screen will behave strangely. It is also for this reason that a routine to scroll up is included (line 260). The cursor ends up one line below the string after a RETURN.

Lines 450 and 460, called as a subroutine in line 220, illustrate a way to trap input errors and notify the user. Errors are checked for whenever the RETURN key is pressed; if one is found the RETURN key doesn't do anything. When a successful RETURN is made, any previous error message is erased (line 240).

The input string, M$, is initialized at line 30. (A preliminary blank avoids out of range subscripts when dealing with the first character position.) It is a simple matter to adapt the Input Line Editor to edit already existing string variables such as records in a file or a string array. Just change line 30 to: 30 M$ = “” + R$, where R$ is the string to be edited.

Taking Advantage Of The Monitor

The POKE in line 80 resets the keyboard strobe, and the PEEK sets X to the ASCII code of the key pressed. The POKE isn't strictly necessary, but it keeps the program from picking up a keypress until it is ready to act on it. You could substitute X = ASC(Z$) for the PEEK, but since this will cause an error in the unlikely event that CONTROL-SHIFT-P is typed, I prefer to PEEK.

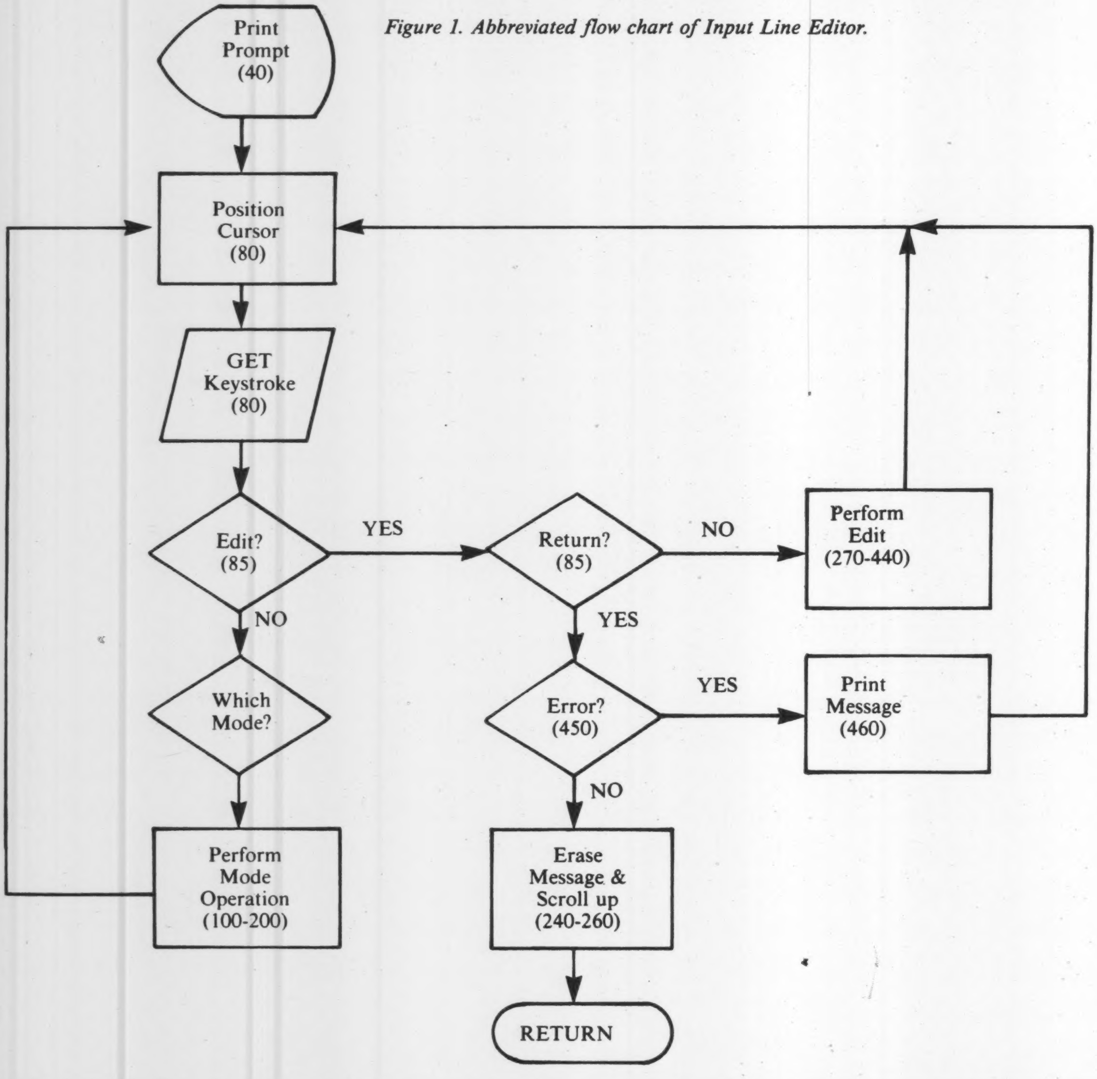
Once X corresponds to the key that was pressed, an ON GOTO can be used to decide how to act on that keypress. Don't forget that both the PEEK and the POKE can be speeded up by using variables in place of the numbers.

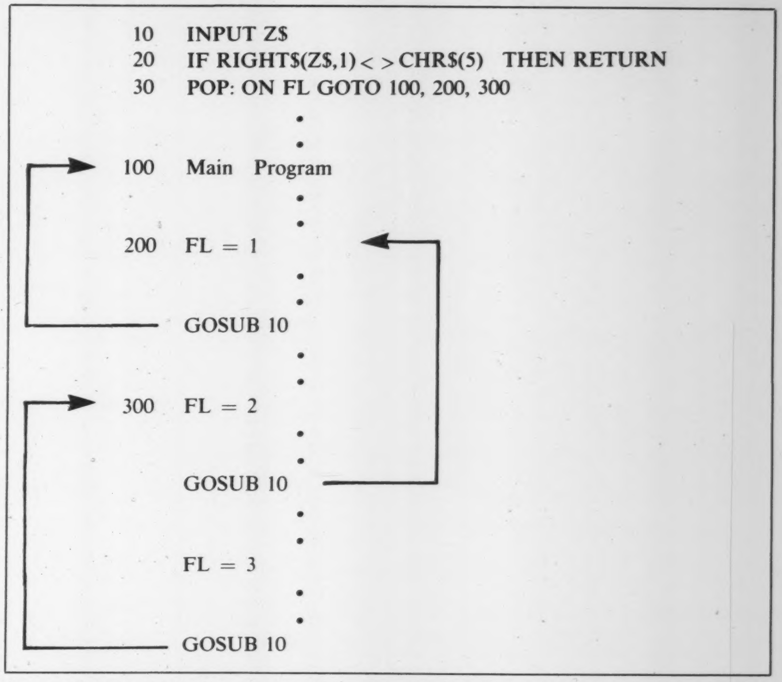
The Apple monitor contains a wealth of useful routines. Three of them are used here:

- 868 Clear line from cursor to right margin.
- 912 Scroll up one line.
- 958 Clear screen from cursor to bottom margin.

Further explanations can be found in the manuals.

Figure 1. Abbreviated flow chart of Input Line Editor.


Print Prompt (40)
Position Cursor (80)
GET Keystroke (80)
Edit? (85)
YES
NO
Which Mode?
Perform Mode Operation (100-200)
Return? (85)
NO
YES
Perform Edit (270-440)
Error? (450)
YES
NO
Print Message (460)
Erase Message & Scroll up (240-260)
RETURN



```
10    INPUT Z$
20    IF RIGHT$(Z$,1)< >CHR$(5)  THEN RETURN
30    POP: ON FL GOTO 100, 200, 300
            •
            •
100   Main  Program
            •
            •
200   FL = 1
            •
            •
      GOSUB 10
            •
            •
300   FL = 2
            •
            •
      GOSUB 10
            •
            •
      FL = 3
            •
            •
      GOSUB 10
```

Figure 2. Hypothetical program with an input subroutine.

Taking Advantage Of Input Subroutines

With the setup that we have discussed here, CONTROL-C will not stop a run as it usually does, but of course it is easy enough to choose another key (say, CONTROL-E) and have that keypress GOTO a line with an END statement. But whenever input is channeled through a subroutine, a further refinement is possible. CONTROL-E could be used to send the program flow to an ON GOTO where the value of a flag determines which line is executed next.

Setting the flag to different values throughout the program means that CONTROL-E becomes an escape whenever there is any input. Where the escape takes you depends upon where you are in the program. For instance, you could use this feature to repeat a previous step or to return to a menu.

If you are using the input subroutine from this article, you can adjust line 85 (as I did by making the fifth line number in the ON GOTO equal 1000) to activate CONTROL-E. But you can still work it in even with a regular INPUT, as Figure 2 shows.

The input subroutine in this figure returns to the main program unless CONTROL-E is typed just before hitting the RETURN key. It doesn't matter what else is typed, so long as CONTROL-E is last.

Figure 2 also shows how you might use CONTROL-E to hop around within a program. The arrows indicate where you would go in this hypothetical example, although actually it can be set up any way you want by juggling the ON GOTO statement. The test program (see next section) has a simple example of this.

Getting back to Listing 2, we see that line 1000 has a POP and a CALL before the ON GOTO. The POP replaces the RETURN in the input subroutine and that is all that is needed if the subroutine is called from the main program.

But if the calling GOSUB is nested inside other GOSUBs or is inside a FOR NEXT loop, the 6502 stack may accumulate unneeded and unwanted return addresses. By clearing the stack each time, you will avoid OUT OF MEMORY errors, and you can do CONTROL-Es all day from anywhere within a program.

Lines 600 and 610 create a short, machine language stack clearing routine (described in Listing 1). I have located it at the ever-faithful (decimal) 768, but it could be POKEd into memory anywhere between 768 and 1023 without interfering with programs, since this area is reserved for the user on the Apple.

A Test Run

The complete Listing 2 is a program that will let you experiment with the various edit functions. The program asks you to enter five strings; after you have finished, they will be printed in their final form. As a demonstration of potential freedom of movement, three different things can happen in response to CONTROL-E.

During the first input, the program will stop. If you type CONTROL-E while inputting either the second or fifth string, you will be backed up and asked again for the first or fourth, respectively. During entry of the third or fourth string, CONTROL-E bumps you forward to the printout.

Programs should always be fumbleproof. Again, for the sake of demonstration, I have arbitrarily defined as unacceptable response: if you enter ABC for any of the strings you will get an error message, and you won't be able to move on to the next step until you change the entry. Naturally, this is a trivial example, but you could easily expand on the idea to flag out of range data, typographical errors, or whatever you wished.

This test program should give you an idea of the speed and usefulness of the Input Line Editor. It is an easy way to put screen editing features into a program. Fifteen control keys have been left unused, so there is room for you to design special functions of your own.

I have been using a version of this program, in conjunction with a data manager, to edit file records.

Added options, such as backspacing through the file one field at a time and jumping ahead to the next record, give it versatility. When you respond to a request for input, you are communicating with the program.

The best kind of communication between humans is open-ended and unrestricted. We should be able to treat computers the same way. END

Listing 1. This stack-initializing subroutine can be relocated anywhere in memory.

```
68      PLA       Load accumulator with top of stack (high byte of return address)
A8      TAY       Transfer to Y register
68      PLA       Load accumulator with low byte of return address
A2 FF   LDX #FF   Load X register with top of stack address
9A      TXS       Initialize stack pointer by transferring X register to it.
48      PHA       Replace low byte of return address onto stack
98      TYA       Transfer high byte to accumulator
48      PHA       Replace high byte onto stack
60      RTS       Return to Basic program
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Input Line Editor, continued...

Listing 2.

```
  5 GOTO 600
 10 REM        INPUT LINE EDITOR
 20 REM          BY ROBERT J BECK
 30 M$=" "
 40 VTAB T: HTAB 1: PRINT PR$: PRINT: PRINT M$;
 50 REMMOVE CURSOR TO BEGINNING OF STRING
 60 L=2
 70 E=1
 80 VTAB T+2: HTAB L: POKE -16368,0: GET Z$: X=PEEK(-16384): VTAB T+2
 85 IF X<32 THEN
      ON X GOTO
      80,60,400,280,1000,380,80,300,360,80,80,80,220,440,80,80,420,80,80,80,3
      30: GOTO 80
 90 REMORDINARY LETTER CHANGES
100 IF E=1 THEN
      M$=LEFT$(M$,L-1)+Z$+MID$(M$,L+1): HTAB L: PRINT Z$;: L=L+1: GOTO 80
110 REMINSERT MODE
120 IF E=2 THEN
      M$=LEFT$(M$,L-1)+Z$+MID$(M$,L): HTAB L: PRINT MID$(M$,L);: L=L+1: GOTO
      80
130 REMIF KEY PRESS NOT SAME AS PREVIOUS ONE TREAT AS ORDINARY LETTER CHANGE
140 F=W: W=X:
    IF F<>X AND F THEN
      E=1: GOTO 100
150 REMLOCATE CHARACTER
160 FOR J=L+1 TO LEN(M$):
      IF Z$<>MID$(M$,J,1) THEN
      NEXT:
      GOTO 80
170 REMMOVE CURSOR TO CHARACTER IF IN FIND MODE
180 IF E THEN
      L=J: GOTO 80
190 REM ELSE DELETE BETWEEN CURSOR AND CHARACTER
200 M$=LEFT$(M$,L-1)+MID$(M$,J): HTAB L: CALL -958: PRINT MID$(M$,L): GOTO
    80
210 REMRETURN --
220 R$=MID$(M$,2): GOSUB 450
230 REMFIRST ERASE ANY ERROR MESSAGE,
240 HTAB 1: VTAB T-1: CALL -868
250 REMTHEN SCROLL UP AND RETURN.
260 FOR E=1 TO LEN(M$)/40+4:
      CALL -912:
    NEXT:
    RETURN
270 REMDELETE ONE CHARACTER
280 M$=LEFT$(M$,L-1)+MID$(M$,L+1): HTAB L: CALL -958: PRINT MID$(M$,L);: GOTO
     70
290 REMBACK ARROW
300 IF L=2 THEN 70
310 L=L-1: GOTO 70
320 REMFORWARD ARROW
330 IF L<1+LEN(M$) THEN
      L=L+1
340 GOTO 70
350 REMSET INSERT MODE
360 E=2: GOTO 80
370 REMSET FIND MODE
380 E=3: W=0: GOTO 80
390 REMSET CUT MODE
400 E=0: W=0: GOTO 80
410 REMCONTROL Q
420 M$=LEFT$(M$,L-1): HTAB L: CALL -958: GOTO 70
430 REMCONTROL N
440 L=LEN(M$): GOTO 70
450 IF M$<>" ABC"THEN
      RETURN: REM RETURN IF NO ERROR
460 HTAB 1: VTAB T-1: PRINT"ERROR!": POP: GOTO 60
470 REM ** END OF INPUT LINE EDITOR
600 FOR I=768 TO 777:
      READ J: POKE I,J:
    NEXT
610 DATA 104,168,104,162,255,154,72,152,72,96
620 FOR I=1 TO 5:
      READ N$(I):
    NEXT
630 DATA FIRST,SECOND,THIRD,FOURTH,FIFTH
800 T=16: HOME:
    FOR I=1 TO 5
810   PR$=N$(I)+" STRING?": FL=I: GOSUB 10: ST$(I)=R$:
    NEXT
820 VTAB 24: PRINT:
    FOR I=1 TO 5:
      PRINT ST$(I):
    NEXT
830 END
950 VTAB T: HTAB 1: CALL -958:
    FOR I=I-1 TO 5:
      GOTO 810
1000   POP: CALL 768: ON FL GOTO 830,950,820,820,950
```

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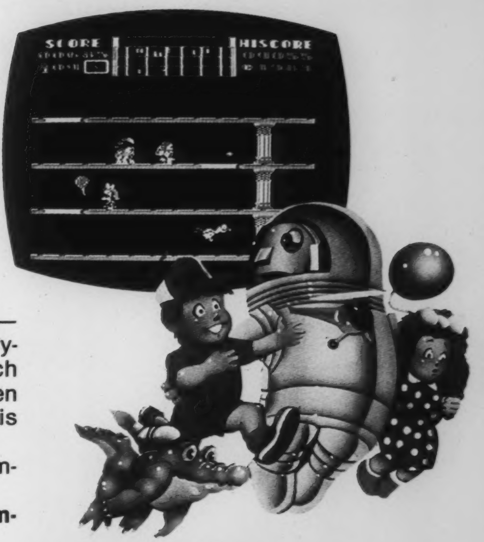

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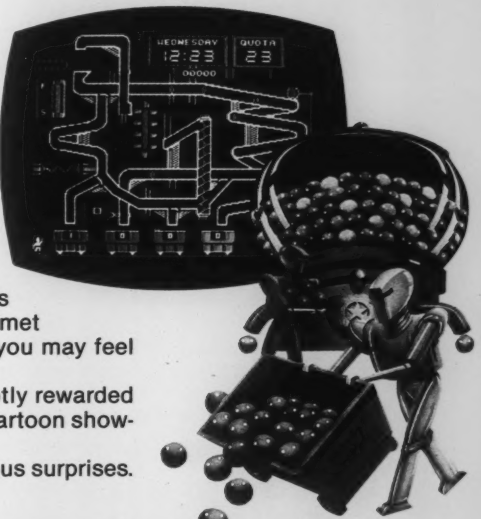

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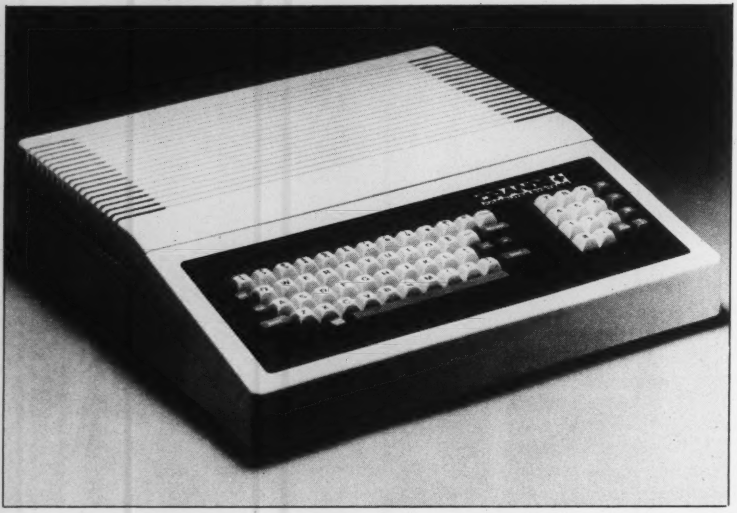

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Apple Basic Programming Using A Word Processor

Richard F. Thompson

Writing Basic code on the Apple computer is usually done using Applesoft or Integer Basic interpreters which provide elementary editing features based on "free cursor" and overwrite. These few tools are certainly adequate for writing and maintaining Basic programs, but they are rooted in the operating system and are somewhat unpleasant for human operators to use for more than casual programming.

If your Apple system includes one disk drive and a word processing program, it may be possible to compose, alter, edit, save, and print out your Basic programs using the more advanced human-oriented capabilities provided by the word processor.

The immediate advantage is a dramatic increase both in programming comfort and in code listing legibility. It is also possible for a word processor to pick up and maintain Basic programs previously written the usual way.

A good word processor can transfer Basic program code from several files to a new program file and thus provide a modular alternative to chaining Basic files that is operationally simpler than the &HOLD-&MERGE operations in the Tool Kit.

Magic Window is being cited in this article because I know from experience that this word processing program does all of the above in fine fashion, and it is splendidly compatible with human Basic programming.

For the method described here, the essential requirement is that the word processor be able to load, edit, and save standard DOS sequential TEXT files which must not contain any non-Basic control characters inserted by the word processor. This is possible when using *Magic Window* by executing the FILER option, UNFORMATTED LOAD/SAVE.

Some word processors do not process DOS TEXT files, and some insert formatting commands into TEXT files.

The essential requirement is that the word processor be able to load, edit, and save standard DOS sequential TEXT files.

An Apple user who already has a library of program code in Basic files will not be taking a step backward if new code is developed and retained in TEXT files, because it is very easy to transfer Basic program code back and forth between Basic files and TEXT files. The word processor is not needed to make these transfers since they are done using Applesoft or Integer Basic, as will be shown below.

One of the unpleasant things about using an Apple to write Basic programs is that when you type a program line and hit RETURN, the interpreter strips away all "unnecessary" blanks and then saves the line in memory in a collapsed form. When the line is listed later, the interpreter first inserts blanks according to its own arcane formula, and then displays a reinflated version of your program line.

The unpleasant result is that your extant program lines seldom resemble the ones you so carefully typed, and the sloppy spacing coupled with weird wraparound makes the code difficult to read and work with. This won't happen with *Magic Window*, since what you type is what you see, forever.

Another nice feature of composing Basic programs on a word processor is that 80-character lines can be maintained and printed on a printer. The word processor will also maintain neat margins, and permit the use of truly blank lines to create paragraph structure in the listing without the obtrusive, numbered REM statement. Having 40 extra columns to work in, and knowing that what you type is what you will see, gives you additional support and incentive to write Basic code and create eye pleasing listings at the same time.

Combining Material From Basic Files

The greatest problem associated with Apple Basic programming may well be that neither Applesoft nor Integer Basic contains a direct way of combining program material from two or more Basic files. Suppose, for example, that a programmer has three tested and true subroutines residing in three different Basic files and that a new programming problem can be solved by executing the three subroutines iteratively. Chaining the files at run time is a clumsy approach to

---

Richard F. Thompson, Highway 5, Box 31, Waldorf, MD 20601.

the problem if only a part of each file is required and if control will be passed back and forth between the three sections of code many times in an unpredictable sequence. This sort of multiple subroutine interplay is common in numerical work.

The swiftest approach to this Basic problem may be to keep all tested and true subroutines in TEXT files and use a word processor to transfer the bits and pieces needed for the task at hand into one new TEXT file. This is easily done using the INSERT FILE command available in *Magic Window.*

After all the pretested tidbits are transferred from the several different TEXT files and brought together in the new problem solving TEXT file, they can easily be renumbered or rearranged as needed by using *Magic Window* CHARACTER-EDITING and LINE-EDITING commands to insert/delete characters and to insert/delete/move/duplicate lines. Then the subroutine pieces can be cemented together by code appropriate to the problem at hand using GOSUBs to invoke them in iterative fashion.

When using a word processor to edit Basic programs on the Apple, all alphabetic characters which are not part of a REM statement must be given in uppercase. As on a typewriter, one initial operation can shift-lock the *Magic Window* keyboard to type all succeeding alphabetic characters in uppercase; this is done either by hitting the ESC key twice in the EDITOR subsystem mode or by entering the CONFIGURATION SUBSYSTEM and setting UPPER CASE ONLY to YES. If lowercase text is desired in REM statements, use the ESC key method since uppercase can be locked or unlocked at any time in the EDITOR subsystem.

Another thing to keep in mind is that every line of Basic code must begin with a line number. In Applesoft, a line of Basic can have up to 239 characters, and it is terminated by hitting the RETURN key. When you use the interpreter, one long Basic line can wrap around onto several 40-character screen lines until the RETURN is reached.

But when you use the *Magic Window*, Basic line length is limited to 80 characters between successive RETURNs, and no wraparound is possible.

The thing to keep in mind is that every Basic line must be contained on one *Magic Window* screen line of 80 characters or less, and it must begin with the statement number. But *Magic Window* will maintain any completely blank lines that you may want to use to give your printed program a nice paragraph structure.

The simple Basic program in Figure 1 was written using *Magic Window* and saved on disk as a TEXT file named FILE1.MW. Note that the user gave the file name FILE1 to the FILER, but *Magic Window* SAVEd the program in a file named FILE1.MW.

Magic Window automatically appends .MW to file names that are given to the FILER for LOAD/SAVE operations, so the disk catalog always shows which TEXT files are compatible with *Magic Window.*

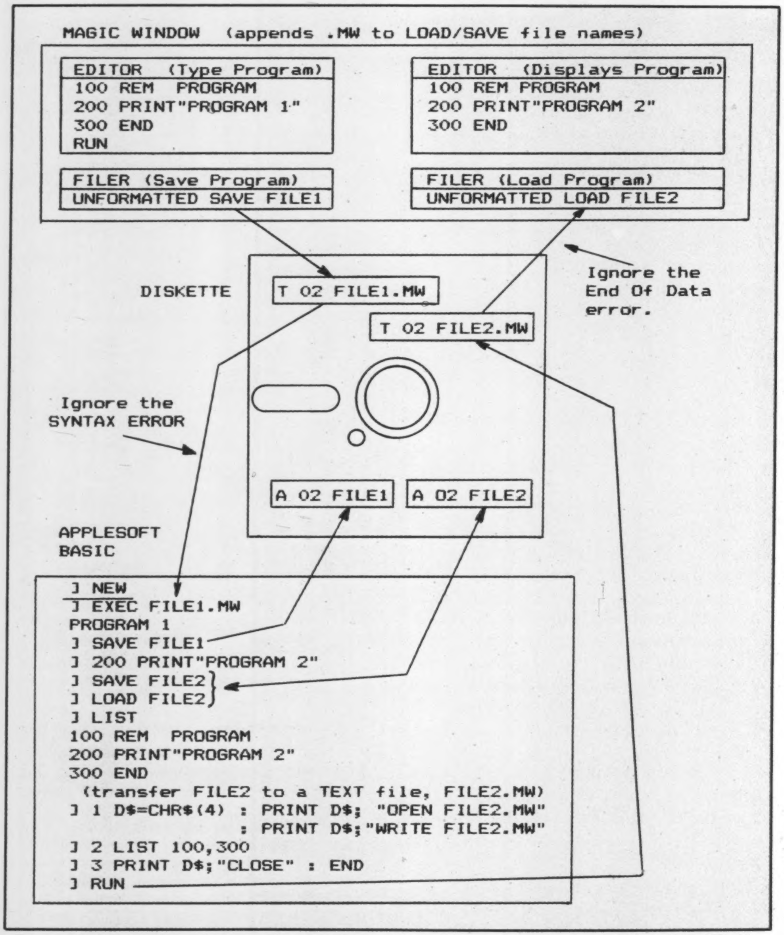
Using EXEC

Because *Magic Window* stores the program on disk in a TEXT file, Applesoft cannot access it with a LOAD or RUN command, but the EXEC command can be used; EXEC FILE1.MW causes the numbered program lines to be loaded into memory right on top of any program lines that may already be in memory. So it is always a good idea to first type NEW before typing EXEC if you don't want program lines already in memory mixing with the lines coming in from your TEXT file.

After line 300 is loaded, EXEC reads the next line, and since this line has no line number, the RUN is treated as an immediate mode command. EXEC immediately executes each immediate mode command in FILE1.MW, so the Basic program is now executed and prints PROGRAM 1.

Being able to imbed immediate mode commands in a file containing a Basic program is another advantage of using TEXT files to store programs. After all the lines have been read from FILE1.MW, EXEC encounters the *Magic Window* End-of-File marker, CTRL-C, which causes the Basic interpreter to issue a SYNTAX ERROR which can be ignored.

Although it may be convenient to im-



```
100 REM  PROGRAM
200 PRINT"PROGRAM 1"
300 END
RUN
```

```
100 REM PROGRAM
200 PRINT"PROGRAM 2"
300 END
```

```
 ] NEW
 ] EXEC FILE1.MW
PROGRAM 1
] SAVE FILE1
] 200 PRINT"PROGRAM 2"
] SAVE FILE2
] LOAD FILE2
] LIST
100 REM  PROGRAM
200 PRINT"PROGRAM 2"
300 END
 (transfer FILE2 to a TEXT file, FILE2.MW)
] 1 D$=CHR$(4) : PRINT D$; "OPEN FILE2.MW"
               : PRINT D$;"WRITE FILE2.MW"
] 2 LIST 100,300
] 3 PRINT D$;"CLOSE" : END
] RUN
```

Figure 1. Magic Window can load, edit and save program code retained in TEXT files (Type T). Applesoft (or Integer Basic) can transfer program code back and forth between TEXT files and Basic files (Type A or I).

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bed immediate mode commands in the TEXT file, it is not necessary to do so. If the TEXT file contains only Basic program (numbered) lines, the EXEC command simply loads them all into memory and returns control to the keyboard. After EXEC loads the program lines into memory, they are identical to program lines that are typed in from the keyboard or read from a Basic file on a disk, so any or all of the usual commands—RUN, LIST, SAVE—can now be given from the keyboard.

It is useful to note what is accomplished when the command SAVE FILE1 is given. As always, the SAVE command simply saves the program back on disk in a standard Apple Basic file. Note that a program which was originally in a TEXT file named FILE1.MW and which was loaded into memory by the EXEC command, will be put back onto disk in a standard Basic file named FILE1 by the SAVE command. In this way, a program can be easily transferred from a TEXT file to a Basic file.

The suffix .MW should be omitted from the name given to the Basic file by the SAVE command, since the Basic file cannot be processed by *Magic Window.* For further illustration, line 200 in memory is changed to PRINT "PROGRAM 2", and the changed program is saved as FILE2 and immediately reloaded and listed.

Transferring From Basic To Text

It is also easy to transfer a program from an Apple Basic file to a TEXT file, a transfer which permits *Magic Window* to take over Basic programs that have been written in the usual way. If the program is on disk as an A or I file, it must first be loaded into memory. Once in memory, it can be saved on disk in a TEXT file which can be picked up by *Magic Window* for program editing. To save a Basic program in a TEXT file when Applesoft is running, simply preface the Basic program code in memory with the following Basic code having program line numbers 1, 2, 3:

```
1 D$=CHR$(4): PRINT D$;
   "OPEN PGM.MW": PRINT D$;
   "WRITE PGM.MW"
2 LIST 4,32767
3 PRINT D$; "CLOSE": END: REM
   Change D$ to <CTRL-D> when
   running Integer Basic.
```

Then when a RUN command is given, only these first three lines are executed, and the remaining lines (the Basic program) will be put on the disk in a TEXT file named PGM.MW, or any name you choose. The LIST command in line 2 causes all program lines having numbers between 4 and 32767 to be transferred to the TEXT file; other limits can be given if only part of the program code is to be transferred to the TEXT file.

Figure 1 shows this method being used to transfer the Basic file, FILE2, to the TEXT file, FILE2.MW. Adding the suffix .MW to the file name in line 1 reminds you that the file is *Magic Window* compatible and forces *Magic Window* to recognize the file as one of its own.

Note that when asked to load the file name FILE2, *Magic Window* loads the file named FILE2.MW; the filer automatically appends .MW to all file names and will not recognize disk files whose catalog names do not end with .MW.

Because FILE2.MW was created by Applesoft, it does not contain the *Magic Window* End-Of-Text marker, so the first time *Magic Window* loads this file, a DOS end of data error, which can be ignored, will occur. The EOT will automatically be inserted later when *Magic Window* saves the file, after which the error message will not occur. Note that when *Magic Window* loads FILE2.MW and displays it in the EDITOR, the RUN statement is missing; it disappeared

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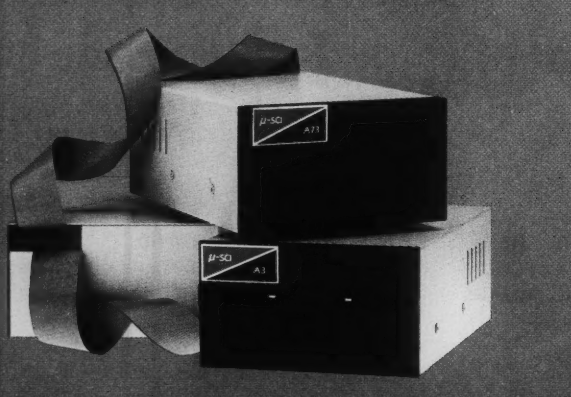

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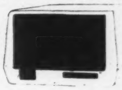

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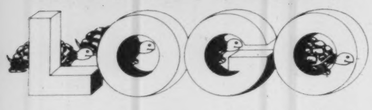

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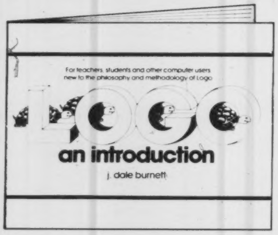
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Apple Basic, continued...

when the EXEC statement executed it in Applesoft instead of storing it in memory.

Summary

This article has described how a particular word processor, *Magic Window*, can be used as a Basic programming aid. As an editor, *Magic Window* is arguably superior to the Applesoft and Integer Basic interpreters. Other word processors that can process TEXT files may also be suitable for program editing.

> ***As an editor, Magic Window is arguably superior to the Applesoft and Integer Basic interpreters.***

A good editor not only eases the task of writing and maintaining program code; it also makes it easy for the programmer to observe simple precepts of composition, such as paragraph structure, that greatly aid the reader by visibly segmenting contiguous subprocesses.

It should be pointed out that the considerable advantages of using a good word processor to develop and maintain Basic programs are achieved at the expense of using TEXT files, because compared to Basic files, TEXT file processing is slower, and TEXT files are less efficient in their use of disk space. But as shown in Figure 1, it is extremely easy to transfer programs between Basic and TEXT files so that the relative inefficiency of TEXT files is a factor only during program editing, and should neither prolong processing nor enlarge archives.

I now use my *Magic Window* disk as an EDITOR disk. It would be useful to have several EDITOR disks containing the same word processor. Unfortunately, *Magic Window* is copy protected, and on a one drive system, you must swap disks to edit Basic programs that are not on the *Magic Window* disk.

This is a significant impediment when several programs are under development, because you frequently need to transfer control between *Magic Window* and Basic to EDIT and RUN the code. If *Magic Window* is not on the disk that contains the program code, you must swap disks after each debug run. This inconvenience is either a good reason for not purchasing a $100, copy-protected word processor, or just one reason for purchasing a $400 second disk drive. END

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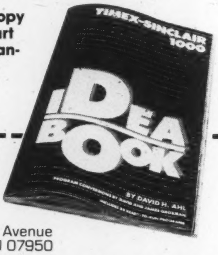

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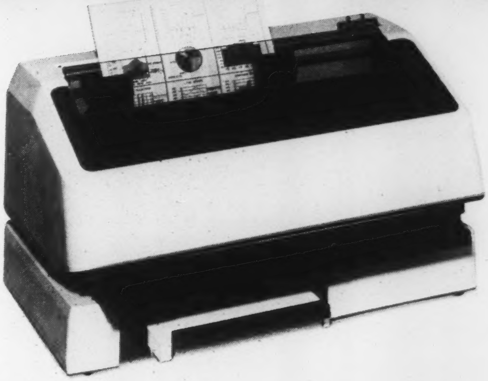

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CIRCLE 185 ON READER SERVICE CARD

Update On FastDraw-80

Richard J. Wagner and Frederick J. Wagner

A reader has brought to our attention a typographical error in one line of our program FastDraw-80 in "Line Drawing Routines for the TRS-80," p. 142 *Creative Computing*, July 1983. The corrected line appears in Listing 1.

In addition, we find that the version of the program we submitted will not work with 32K RAM. However, we have revised FastDraw-80 so that it can be used on TRS-80s with as little as 16K RAM. Listing 2 shows the lines to add or change. The major addition is a subroutine that will "patch" the machine language drawing routine after it has been loaded into memory.

The revised program allows the user to adjust the location where the drawing routine is built. The value of L in line 27 is simply set to the number of 1K (1024 or 0400 hex) increments to change the load point from the default 0C00 hex.

For example, if L is set to -4, the drawing routine will be built 4K lower at 45056 (0B000 hex), well within 32K RAM. (The highest address with 32K RAM is 0BFFF hex.) To move the routine as high as possible in 48K RAM, set L to +15. The user with cassette Basic and only 16K RAM can set L to -17 and use the alternate form of USR call shown in the listing.

The patch subroutine is called only if L has a non-zero value. It changes the most significant byte of the internal memory references of the drawing routine, based on the value of L. Users with disk Basic can save the routine on disk or cassette; they need patch it but once.

We apologize for any inconvenience caused to readers with 32K TRS-80s, and hope that users with under-32K of RAM will find the revised program useful. END

Richard J. Wagner and Frederick J. Wagner, 11920 N.W. Oatfield Ct., Portland, OR 97229.

```
1019 REM

FIX OF TYPOGRAPHICAL ERROR IN ONE LINE OF PUBLISHED PROGRAM:

1020 AS$(1)="2AFCC3ED5BFEC3443E2F90F8423E2F90F8453E7F90F8433E7F9"
```

Listing 1.

Listing 2.

```
3 REM
  You can set a Parameter L in line 27 to use Program
  with as little as 16K RAM. You can have
  DISK- or cassette BASIC.
9 REM
  FASTDRAW is initalized to DRAW (SET) lines.
  To erase (RESET) lines instead, POKE L2,134.
  To go back to drawing lines, POKE L2,198.
  L2 is the load location of the drawing subroutine + 1
  (by default it is -16383).
21 REM

BY DEFAULT, PROG STORES AT &HC000

22 L1=-16384
   :L2=L1+1
   :L3=L1+394 :REM PROG ENTRY
27
   L=0 :REM Default value for &HC000. Change by 1 Per 1K
        change desired in Prog location, e.g. change to
        "L=-4" to load at &HB000 (for 32K RAM).

28 REM

Adjust Prog storage and load Points,as specified by value of L:

29 L4=L*4
   :L5=L4*256
   :L1=L1+L5
   :L2=L2+L5
   :L3=L3+L5
   :PRINT"Respond to MEMORY SIZE with"L1  +65535"
or smaller when running this Program."
35 GOSUB 1000
   :IF L THEN GOSUB 3000 :REM CALL NEW S/R TO MODIFY ASSY LANG
                          PROG TO  WORK AT NEW LOAD ADDRESS.
70 POKE L2,198  .'Draw next set of lines
80 A=USR(VARPTR(Z(0,1)))
   :A=USR(VARPTR(Z(0,0)))
   :POKE L2,134  'Now erase
1060 N=L1
     :FOR H=0 TO 4
     :AT$=AS$(H)
     :GOSUB 1070
     :NEXT H
     :GOTO 1080
1080 DEFUSR=L3
     :REM
    For non-disk BASIC type in line 1080 to look like this:
     POKE 16526,138
     :POKE 16527,194+L4
2000 Z(Z(0,P)*2+1,P)=X2+INT(Y2)*256
     :Z(Z(0,P)*2+2,P)=X1+INT(Y1)*256
     :Z(0,P)=Z(0,P)+1
     :RETURN
2990 REM

SUBROUTINE 3000 MODIFIES ABSOLUTE ADDRESSES OF THE MACHINE
LANGUAGE DRAW ROUTINE AFTER IT HAS BEEN LOADED INTO MEMORY.

2999 REM

IT EXAMINES 435 BYTES OF MEMORY STARTING AT L1 AND CHANGES
VALUES STORED AS NEEDED. NOTE: THIS IS NOT A GENERAL-PURPOSE
ROUTINE, BUT ONE SPECIFICALLY DESIGNED FOR THE PROGRAM IT MUST
MODIFY.

3000 I=L1-1
     :K=I+435
3005 I=I+1
     :IF I>K THEN RETURN ELSE J=PEEK(I)
3010 IF J<>87 AND J<>95 THEN 3017
     ELSE IF PEEK(I+3)<>192 THEN 3017
     ELSE I=I+3
     :GOTO 3005
3017 IF J<>205 THEN 3020
     ELSE I=I+1
     :J=PEEK(I)
     :IF J<>176 THEN 3020
     ELSE I=I+1
     :J=PEEK(I)
     :IF J<>193 THEN 3020
     ELSE POKE I,J+L4
     :GOTO 3005
3020 IF J=225 THEN I=I+1
     :GOTO 3005
3030 IF J=192 THEN POKE I,J+L4
     :GOTO 3005
3040 IF J=195 THEN POKE I,J+L4
3050 GOTO 3005
```

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CIRCLE 120 ON READER SERVICE CARD

A Monitor Program For Vic 20

Warren Clark

"What's a monitor program?" my sister asked. I had just returned to the family homestead for the Christmas holidays and had been very anxious to try out Janice's new Vic 20 computer. Naturally, I wasn't satisfied to play with Basic for very long, and I wanted to do some PEEKing around.

As an old Apple user, I was very surprised to find that the Vic did not come with a monitor program. I decided to write one for her. This article briefly explains the need for a monitor program, what it should do, and the structure and organization of this one.

To answer my sister's question as to what a monitor program is, we must first discuss what memory is. Almost everyone knows how many K of memory he has in his computer. Each K of memory represents 1024 bytes of information. Each byte has a unique location in the computer memory which is referred to as the *address* of that byte. Each of these bytes holds eight bits of information.

This information could represent any of a number of different things. The byte could represent part of a machine language program. It could represent the value of a variable or one character in a character string. It could also be a pointer to other information. There are pointers to the start of the Basic program, to the current line of the Basic program, to the start of variable storage, and all kinds of really neat and interesting things. The information that I wanted to look at on the Vic was the high-resolution bit patterns used by the Vic for writing characters on the screen.

If a programmer wants to examine or change these locations while writing a program, he can do so by using the PEEK and POKE commands. This can be very time consuming since the sequence PRINT PEEK (address) must be keyed for each byte being examined. Similarly, the sequence POKE address,value must be keyed for each value entered.

The problem passes the point of ridiculousness when a machine language program must be entered. The novice machine language programmer often does not have an assembler. Without an assembler, the programmer must assemble the program by hand, and then enter it by hand. Even a small program could require hundreds of POKEs followed by hundreds of PEEKs to verify that everything has been entered correctly.

A good monitor gets around these problems. It allows the programmer to examine memory locations sequentially. As each location is examined, the operator has the option of changing it or looking at the next one. A good monitor program also allows the operator to list a range of memory all at once. A third monitor feature allows the operator to move a range of memory to a new location in the computer. A final feature in a good monitor is the ability to execute and return from a machine language program.

> ***A good monitor program allows the operator to list a range of memory all at once.***

Hex To Decimal And Back

Everything entered into or printed by the program is in hexadecimal. This is good because it allows the experienced user to visualize the actual bit patterns of the addresses and data. It is bad because the Vic manual gives most addresses and the contents of those addresses in decimal. To get around that problem, I decided that my Vic monitor would also provide utilities for hex to decimal and decimal to hex conversion.

Writing The Program

Given this set of requirements, I set out to write the monitor program. I wondered if it would be possible to write such a program in Basic. To be perfectly honest, I have never heard of a monitor program being written in anything but machine language. Unfortunately, writing it in machine language promised to be a very time-consuming task (especially considering that I would have had no good way of getting it into the machine until after it was already there). Also, I couldn't think of any reason not to write it in Basic, and I must admit that my laziness got the best of me.

The program consists of a primary loop, two secondary loops, and several subroutines called by these loops. All three of the loops look for various delimiters. These delimiters are actually the commands to the monitor program from the operator. Spacebands tell it to display a memory location. A return tells it to go back to the primary loop or if it is already in the primary loop to exit the monitor program. A period tells it to save what was just entered as an address for future use and to allow the operator to enter another address. The letters G, L, and M command the monitor to GOTO a particular location, LIST a range of memory, or MOVE a range of memory. H and T tell it to do a number conversion.

The primary loop (100-160) gets an input byte followed by a delimiter and branches accordingly.

If the primary loop finds a spaceband, it calls the examine and change subroutine (1000-1210). Examine and change displays the memory location, allows the operator the opportunity to change it, and then displays the next

---

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location. This process continues until the operator hits RETURN.

If the primary loop finds a period, it calls the period processing subroutine (3000-3080). Period processing allows the operator to enter up to two more addresses and then branches to either the list or the move subroutine.

If the primary loop finds any of the other control delimiters, it either performs the action directly or branches to a single subroutine which performs the action. Commands which are processed directly are the exit program and hex to decimal conversion. Commands which are processed by subroutines are those which execute machine language routines and convert from decimal to hex.

Two subroutines at the end of the program function as utilities for the loops and other subroutines. These are the input and output routines. The input routine (starting at 9000) gets a hexadecimal character string from the keyboard. It allows characters to be entered until it encounters a non-hexadecimal character. When it does find the non-hex character, it returns.

This is a case where "standard" Basic is not standard.

When it returns, the value of the hex string is held in variable IV. If no hex characters were entered, IV returns a value of negative one.

The second utility subroutine (starting at 9100) is for output. It outputs the hexadecimal value held by IV. It gives the output string a length which is one greater than the value in I. In other words, if I holds a value of 1, a two-character sequence will be produced; if I holds a value of 3, a four-character sequence will be set to the screen.

Compatibility

One additional note is in order at this point. Line 2020 varies depending on host machine. This is a case where "standard" Basic is not standard. In Applesoft, for example, the command to execute a machine language routine is CALL. On the Vic 20, the command is SYS. Because my Apple is equipped with a disk drive and a printer, I used it for the program development effort. That one line was the only incompatibility between the two programs. Although I haven't tried it, I presume that this program will work on most other small computers, as well. END

Listing 1.

```
5  REM *****************************************************************
10  REM GENERAL PURPOSE MONITOR PROGRAM
12  REM
14  REM         WARREN CLARK
16  REM         DECEMBER 25, 1982
18  REM
20  REM THIS PROGRAM PERFORMS THE FOLLOWING FUNCTIONS
22  REM         EXAMINE SINGLE MEMORY LOCATION
23  REM         CHANGE SINGLE MEMORY LOCATION
24  REM         GOTO AND EXECUTE AT PARTICULAR LOCATION
25  REM         CONVERT HEX NUMBER TO DECIMAL
26  REM         LIST A RANGE OF MEMORY LOCATIONS
28  REM         MOVE A RANGE OF MEMORY LOCATIONS
30  REM         CONVERT BASE TEN NUMBER TO HEXACECIMAL
32  REM
34  REM PROGRAM STARTS WITH COLON (:) AS A PROMPT
36  REM
38  REM TO EXAMINE AND CHANGE MEMORY, ENTER HEX ADDRESS FOLLOWED BY SPACE
40  REM         SYSTEM DISPLAYS CONTENTS OF THAT ADDRESS
42  REM         SPACEBAND CAUSES CONTENTS OF NEXT ADDRESS TO BE DISPLAYED
44  REM         TWO HEX DIGITS FOLLOWED BY SPACE STORES NEW CONTENTS
46  REM         RETURN KEY CAUSES RETURN TO COLON PROMPT
48  REM
50  REM TO LIST A RANGE OF MEMORY ENTER TWO ADDRESSES FOLLOWED BY "L"
52  REM         USE PERIOD AS DELIMETER
54  REM         FORMAT IS  :AAAA.AAAAL
56  REM
58  REM TO MOVE A RANGE OF MEMORY ENTER THREE ADDRESSES FOLLOWED BY "M"
60  REM         FIRST ADDRESS IS FIRST LOCATION TO BE MOVED
62  REM         SECOND ADDRESS IS LAST LOCATION TO BE MOVED
64  REM         THIRD ADDRESS IS NEW LOCATION OF CONTENTS OF FIRST ADDRESS
66  REM         USE PERIODS AS DELIMTERS
68  REM         FORMAT IS  :AAAA.AAAA.AAAAM
70  REM
72  REM  TO EXECUTE A MACHINE LANGUAGE ROUTINE ENTER ADDRESS FOLLOWED BY "
     G"
74  REM         FORMAT IS  :AAAAG
76  REM
78  REM TO EXIT PROGRAM HIT RETURN AFTER COLON PROMPT
80  REM
82  REM ALL NUMBERS ARE ENTERED AND DISPLAYED IN HEX
84  REM
86  REM TO CONVERT A HEX NUMBER TO BASE TEN ENTER NUMBER FOLLOWED BY "T"
88  REM          FORMAT IS :AAAAT
90  REM
92  REM TO CONVERT A DECIMAL NUMBER INTO HEX ENTER NUMBER FOLLOWED BY "H"
94  REM          FORMAT IS :AAAAH
96  REM
100  REM GENERAL PURPOSE MONITOR PROGRAM
102  REM ************************************************************
110  PRINT : PRINT ":";
115 LV = 1
120  GOSUB 9000: REM GET INPUT
122  IF IN = 72 THEN  PRINT " DECIMAL VALUE IS ";IV
125  IF IN = 13 THEN  END : REM RETURN
127  IF IN = 84 THEN  GOSUB 6000: REM   "D"
129 IV = IV - 65536 *  INT (IV / 65536): REM   VALUE MUST BE < 65536
130  IF IN = 32 THEN  GOSUB 1000: REM  " "
140  IF IN = 71 THEN  GOSUB 2000: REM  "G"
150  IF IN = 46 THEN  GOSUB 3000: REM  "."
160  GOTO 110
1000  REM ***********************************************************
1001  REM
1002  REM SECTION TO EXAMINE AND CHANGE MEMORY
1003  REM
1004  REM ***********************************************************
1050 I1 = IV
1100  REM  OUTPUT CONTENTS
1110 IV =  PEEK (I1):I = 1: GOSUB 9100
1120  GOSUB 9000: REM GET NEW CONTENTS FOR LOCATION I1
1130  IF IV =  - 1 THEN 1200: REM WAS A HEX NUMBER ENTERED? IF NOT, SKIP T
     O 1200
1140 IV = IV - 256 *  INT (IV / 256): REM VALUE MUST BE < 256
1150  POKE I1,IV
1200  IF IN = 13 THEN  RETURN : REM RETURN
1210  IF IN <  > 32 THEN 1120: REM SPACE
1299  REM NEXT 4 LINES COMPUTE NEXT ADDRESS, DISPLAY IT, AND GOTO 1100
1300  PRINT : PRINT ":";
1310 I1 = I1 + 1:IV = I1:I = 3
1320  GOSUB 9100
1330  GOTO 1100: REM GO BACK AND OUTPUT CONTENTS
2000  REM ***********************************************************
2001  REM
2002  REM ROUTINE TO EXECUTE MACHINE LANGUAGE SUBROUTINE
2003  REM
2004  REM NOTE THAT LINE 2020 IS "CALL I1"
2005  REM IN VIC-20, THIS MUST BE CHANGED TO "SYS I1"
2006  REM
```

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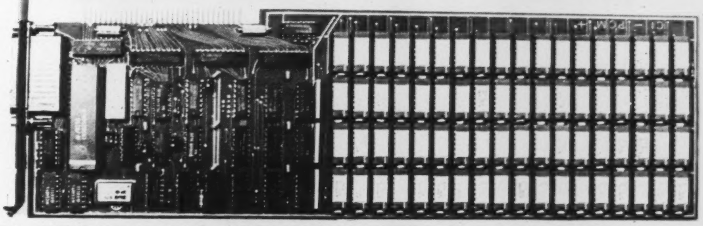

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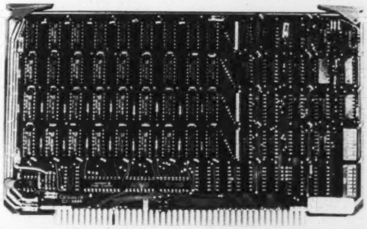

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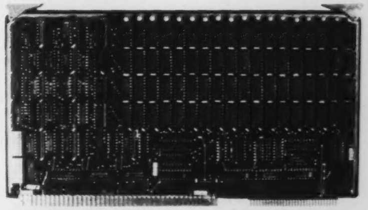

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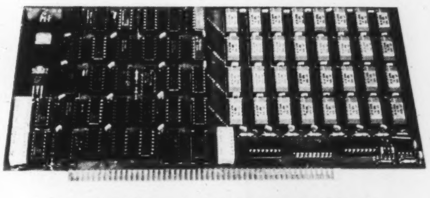

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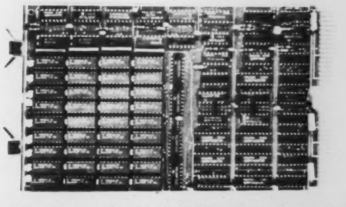

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Monitor Program, continued...

```
2007  REM **********************************************************
2010 I1 = IV
2020  CALL I1
2030 IV = 0:IN = 0: RETURN
3000  REM **********************************************************
3001  REM
3002  REM ROUTINE FOR PROCESSING A PERIOD
3003  REM
3004  REM PUT CONTENTS IF "IV" INTO "I1" OF "I2" DEPENDING ON "LV"
3005  REM
3006  REM **********************************************************
3010  IF LV = 1 THEN I1 = IV
3020  IF LV = 2 THEN I2 = IV
3030  IF LV < 3 THEN LV = LV + 1
3040  GOSUB 9000
3041 IV = IV - 65536 *  INT (IV / 65536): REM VALUE MUST BE < 65536
3050  IF IN = 46 THEN  GOTO 3000: REM   "."
3060  IF IN = 76 THEN  GOSUB 4000: REM  "L"
3070  IF IN = 77 THEN  GOSUB 5000: REM  "M"
3080  RETURN
4000  REM **********************************************************
4001  REM
4002  REM ROUTINE TO LIST A RANGE OF MEMORY 4 BYTES AT A TIME
4003  REM
4004  REM **********************************************************
4010  PRINT
4020  FOR J = I1 TO IV STEP 4
4030 IV = J:I = 3: GOSUB 9100
4040  FOR K = 0 TO 3
4050 I = 1:IV =  PEEK (J + K): GOSUB 9100
4060  NEXT
4070  PRINT
4080  NEXT : RETURN
5000  REM **********************************************************
5001  REM
5002  REM ROUTINE TO MOVE A RANGE OF MEMORY
5003  REM
5004  REM **********************************************************
5005 K = 1: IF I2 - I1 < 0 THEN K =  - 1
5010  FOR J = 0 TO I2 - I1 STEP K
5020  POKE IV + J, PEEK (I1 + J)
5030  NEXT : RETURN
6000  REM ***********************************************************
6001  REM
6002  REM ROUTINE TO CONVERT DECIMAL NUMBER TO HEX
6003  REM     SINCE THE MACHINE THOUGHT THE OPERATOR WAS KEYING HEX
6004  REM     WHEN THE NUMBER WAS ENTERED, IT MUST BE BROKEN
6005  REM     APART AND REBUILT.
6006  REM
6009  REM ***********************************************************
6010 I1 = 0
6020  FOR I = 5 TO 0 STEP  - 1
6030 I2 =  INT (IV / 16 ^ I):IV = IV - I2 * 16 ^ I
6040 I1 = 10 * I1 + I2
6050  NEXT I
6060 IV = I1:I = 1: IF IV > 255 THEN I = 3
6070  PRINT " HEXADECIMAL VALUE IS ";: GOSUB 9100
6080  RETURN
9000  REM **********************************************************
9001  REM
9002  REM ROUTINE TO INPUT A HEX DIGIT FROM THE KEYBOARD
9003  REM HEX DIGITS ENTERED AND SHIFTED LEFT UNTIL NON HEX DIGIT IS FOUND
9004  REM ROUTINE RETURNS -1 IF NO HEX DIGITS ENTERED
9005  REM
9006  REM **********************************************************
9010 IV =  - 1
9020  GET IN$: IF IN$ = "" THEN 9020
9030  PRINT IN$;:IN =  ASC (IN$)
9040  IF IN < 48 OR IN > 57 AND IN < 65 OR IN > 70 THEN  RETURN
9050 IN = IN - 48: IF IN > 9 THEN IN = IN - 7
9055  IF IV < 0 THEN IV = 0
9060  IF IV < 0 THEN IV = 0
9070 IV = IV * 16 + IN
9080  GOTO 9020
9100  REM **********************************************************
9101  REM
9102  REM ROUTINE TO OUTPUT THE HEX NUMBER IN VARIABLE "IV"
9103  REM    VARIABLE "I" HOLDS NUMBER OF DIGITS TO BE PRINTED MINUS 1
9104  REM    ROUTINE CLEARS IV
9105  REM
9106  REM **********************************************************
9110  IF IV >  = 16 ^ (I + 1) THEN IV = 16 ^ (I + 1) - 1: PRINT "IV TOO LA
    RGE";: RETURN
9120  FOR I = I TO 0 STEP  - 1
9130 I2 =  INT (IV / 16 ^ I):IV = IV - I2 * 16 ^ I
9140  IF I2 > 9 THEN I2 = I2 + 7
9150  PRINT  CHR$ (I2 + 48);: NEXT
9160  PRINT " ";: RETURN
```

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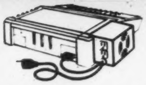

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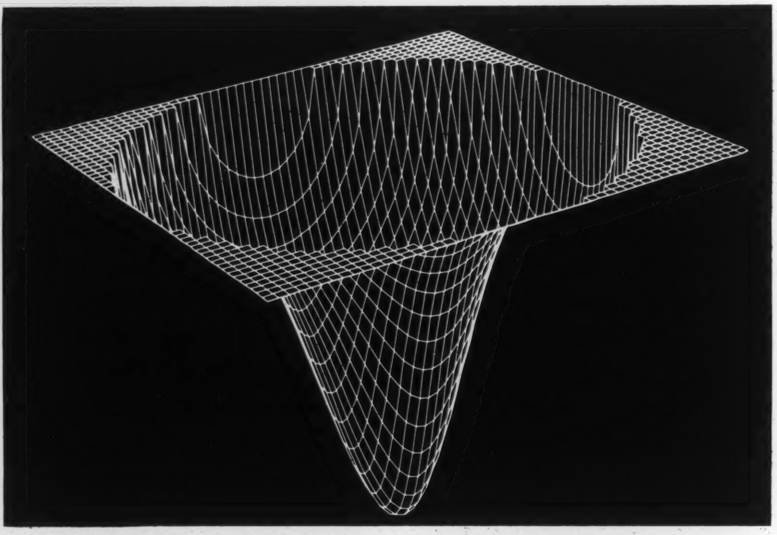
CIRCLE 117 ON READER SERVICE CARD

An Applesoft Simulation

GRAVITY

Chris Williams



Back in the 60's, a rash of grade B science fiction movies dealt with space flight. In these movies there were certain scenes that the writers apparently felt were required. I suspect you can remember them as well as I can.

First, there was the dramatic blastoff scene that was actually a bit boring. Then there was a brief zero-g demo that gave the special effects people a chance to show off. And then there was my favorite, the meteor storm/repair damage scene.

In this scene a meteor storm would damage something on the hull and someone would have to suit up and go outside to fix it. Naturally, he would manage to leave his lifeline undone and then would kneel down and break the contact of his magnetic soles with the hull. Off he would go. The stage was now set for some exotic rescue techniques ranging from oxygen cylinder propulsion to lassoing. Exciting stuff.

The program is an excellent example of iteration.

But I have often wondered about that. Suppose, air permitting, he just took a nap. The ships in those movies were massive. His initial radical velocity was low, as he certainly didn't push off. Would gravity reel him in within a reasonable time period?

The Applesoft program I present here can answer that question. It allows you to place two theoretical objects in space and watch their mutual gravitational attraction take effect. You can define the mass of each object, its initial distance from the other, and an initial velocity. Then you turn them loose and watch them pull themselves together to impact. Their final statistics (velocities, distances traveled, and time) are displayed.

The program is written in Applesoft Basic and runs reasonably fast depending on your choice of delta time. The algorithm uses Newton's gravity equation $F=MmG/R^2$ and his force equation $F=ma$. Both are implemented in a loop that continually updates each along with velocities and distances.

Prompts for the initial condition inputs are sufficiently detailed to prevent errors. Units, which are metric, are kept consistent throughout the program.

The program is an excellent example of iteration in that, unlike many programs, this one has several interdependent variables all of which are updated in the loop. Most iterative routines update only one variable. The program also illustrates the conventional method of performing integration on a computer.

While I am on that subject let me mention a few things about delta time (DT). DT is the period of pseudo-time that each iteration represents. If you could select an infinitely small DT, the program would yield perfect (for an 8-bit machine) accuracy.

But if you select a tiny DT, the program will take forever to run. So you must compromise execution time with accuracy. I think you will find that accuracy doesn't really suffer too much as you increase DT, because the error is not linear. If you are concerned, try several different DTs for the same problem and graph your results. You will discover that time-to-impact begins to look asymptotic with surprisingly large DTs.

Finally, the program should not be difficult to modify. The iterative print statement could display other variables. The masses themselves could be made variable (simulating fuel burning in a rocket). Or you could get fancy and add a Lorentz transformation to my relativistic subroutine, which currently does nothing but exit when the velocity of an object exceeds .lc. This could prove interesting with very large masses like stars and planets.

Chris Williams, 5676 S. Meadow Lane, Ogden, UT 84403.

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Listing.

```
10  REM *** GRAVITY ***
20  REM *** BY CHRIS WILLIAMS ***
25  REM  PRINT INSTRUCTIONS
30  GOSUB 2000
40  HOME : PRINT : PRINT : PRINT : PRINT : PRINT "ENTE
     R INITIAL DISTANCE": PRINT : INPUT "BETWEEN MASSE
     S (METERS); ";R
50  PRINT : PRINT : INPUT "ENTER MASS #1 (KGS.) ";M1
60  PRINT : PRINT : INPUT "ENTER MASS #2 (KGS.) ";M2
65  PRINT : PRINT : INPUT "ENTER DELTA T (SECS.) ";DT
70  PRINT : PRINT : INPUT "FINISH DISTANCE (OBJECTS' R
     ADII) ";UN:
72 HAF = .5:TC = 3E8 * .1
75 G = 6.67E - 11: REM (IN NT-M^2/KG^2)
76  REM  GO DO ESCAPE VELOCITY CALC
78  GOSUB 4000
80 F = (M1 / (R * R)) * G * M2
120 A1 = F / M1:A2 = F / M2
125  REM  THE /2 IS FOR AVG DURING DT
130 V1 = V1 + A1 * DT / 2:V2 = V2 + A2 * DT / 2
132  REM  CHECK FOR RELATIVISTIC
135  IF V1 > TC OR V2 > TC THEN  GOTO 5000
138  REM  CALC DISTANCE THIS DT
140 D1 = HAF * A1 * (DT * DT) + (V1 * DT):D2 = HAF * A
     2 * (DT * DT) + (V2 * DT)
145  REM  UPDATE NEW RANGE
150 R = R - D1 - D2
155  REM  CALC TOTAL DISTANCE MOVED
160 L1 = L1 + D1:L2 = L2 + D2
165  REM  ARE WE DONE??
170  IF R <  = UN THEN  GOTO 250
175  REM  COUNT USED TO CALC TIME
180 COUNT = COUNT + 1
185  PRINT "F= ";F; TAB( 20);"R= ";R
187  REM  NOT DONE YET, LOOP BACK
200  GOTO 80
240  REM  DONE, PRINT FINAL STATS
250  FLASH : PRINT : PRINT : PRINT "DONE!!!!": NORMAL
     : FOR U = 1 TO 5: PRINT  CHR$ (7): NEXT
260  PRINT : PRINT : PRINT "TIME WAS ";COUNT * DT;" SE
     CS."
270  PRINT : PRINT "THAT'S ";COUNT * DT / 3600.;" HRS.
     "
280  PRINT : IF (COUNT * DT / 3600.) > 24. THEN  PRINT
     "OR ";COUNT * DT / 3600. / 24.;" DAYS"
290  PRINT : PRINT : PRINT "VELOCITIES WERE (M/SEC)": PRINT
     : PRINT "VM1= ";V1;"  VM2= ";V2
300  PRINT : PRINT "DISTANCES TRAVELED WERE (METERS)":
      PRINT : PRINT "DM1 = ";L1;" DM2 = ";L2
400  END
1050  REM  INSTRUCTIONS
2000  HOME : PRINT "            *** GRAVITY ***"
2010  PRINT : PRINT
2020  PRINT "     THIS PROGRAM ALLOWS YOU TO INVESTIGA
     TE THE EFFECTS OF THE FORCE OF GRAVITY.  BY PLAYI
     NG WITH THE INPUTS YOU'LL BE ABLE TO DEVELOP A RE
     AL 'FEEL' FOR THE STRENGTH OF THIS UNIVERSAL FORC
     E."
2030  PRINT "     YOU CAN SPECIFY TWO MASSES AT A FIXE
     D DISTANCE APART AND WATCH THEM PULL THEMSELVES T
     OGETHER TO A FINAL DISTANCE (OBJECTS' RADII).  TH
     E DELTA TIME INPUT ALLOWS YOU TO VARY THE SIZE OF
      THE TIME INCREMENT."
2040  PRINT "     THIS DELTA TIME UPDATE IS AN IMPORTA
     NT INPUT.  THOSE OF YOU WITH CALCULUS KNOW WHY; T
     HOSE OF YOU WITHOUT CAN FIND A BRIEF DISCUSSION O
     F THE PROBLEM IN THE ARTICLE.  SUFFICE TO SAY YOU
      MUST COMPROMISE, ACCURACY VS. TIME."
2045  PRINT : PRINT : PRINT "HIT ANY KEY TO CONTINUE":
      GET P$
2047  HOME
2050  PRINT "     ENOUGH OF THAT THOUGH, THE BEST WAY
     TO SEE WHAT'S HAPPENING IS TO TRY IT A FEW TIMES.
       I SUGGEST YOU GO WITH TWO 1000 KG. MASSES 10 ME
     TERS APART AS A FIRST LOOK.  STOP AT 1 METER AND
     USE A DELTA T OF 100 SECS."
2060  PRINT "     AFTER THAT YOU CAN LET YOURSELF GO A
     ND START DROPPING PLANETS INTO STARS OR PEOPLE IN
     TO PLANETS OR PERHAPS EVEN WRENCHES INTO SPACE SH
     UTTLES.  JUST BE CAREFUL OF THE APPLESOFT REAL VA
     RIABLE SIZE OVERFLOW."
2070  PRINT "     I'VE CONSTRUCTED THE FORCE EQUATION
     TO MINIMIZE THIS BUT IT STILL WARRANTS ATTENTION.
       NO BIG DEAL, REALLY, JUST KEEP YOUR PLANETS AND
      STARS SMALL ENOUGH."
2080  PRINT "     OKAY, I'LL SHUT UP NOW AND Y'ALL CAN
      HAVE AT IT.": PRINT : PRINT : PRINT : PRINT "HIT
      ANY KEY TO CONTINUE": GET P$: RETURN
4000  HOME : PRINT : PRINT : PRINT "BECAUSE I NEED A F
     IXED REFERENCE FRAME I CAN ONLY LET YOU GIVE ONE
     MASS AN INITIAL VELOCITY.  IT WILL BE YOUR LEAST
     MASSIVE OBJECT WHICH IS:"
4005  REM  CALC ESCAPE VELOCITY
4010  PRINT : IF M1 > M2 THEN  GOTO 4040
4020  PRINT "       M1"
4022 EV =  SQR (2 * G * M2 / R)
4024  PRINT : PRINT "ESCAPE VELOCITY IS ";EV;" M/SEC."
     : PRINT "DON'T EXCEED IT.": PRINT : PRINT "GO AHE
     AD"
4027  INPUT V1:V1 =  - V1
4030  GOTO 4050
4040  PRINT "             M2"
4042 EV =  SQR (2 * G * M1 / R)
4044  PRINT : PRINT "ESCAPE VELOCITY IS ";EV;" M/SEC."
     : PRINT "DON'T EXCEED IT.": PRINT : PRINT "GO AHE
     AD"
4047  INPUT V2:V2 =  - V2
4050  RETURN
4100  REM  V>.1*C,NOTIFY AND PRINT STATS
5000  PRINT "SORRY PAL, ONE OF YOUR MASSES JUST WENT R
     ELATIVISTIC"
5005  FOR BZ = 1 TO 90:BB =  PEEK ( - 16336): NEXT
5010  GOTO 260
```

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CIRCLE 175 ON READER SERVICE CARD

In the Singular

David Leithauser

One minor but annoying problem with computer output is the matter of singular and plural. For example, a game might have a program line which reads PRINT “YOU HAVE ”;N;“MISSILES LEFT”. This works fine if you have zero or more than one missile left, but it is grammatically incorrect if there is exactly one of the object (missiles in this case). Here I offer a simple technique for cleaning up the output.

This technique relies on the fact that home computers actually treat logical comparisons (such as equal or greater than) as mathematical functions which generate a number. For example, if you tell the computer to PRINT 1=2, most computers will print a 0. If you tell the computer to PRINT 1=1, most computers will print either a 1 or a -1. TRS-80 Level II Basic, for example, gives a -1, while the Atari and Apple II give a 1. This fact can be used to choose a subscripted string variable, such as the letter S or an empty string.

Taking the TRS-80 as an example, you can start the program with DIM S$(1): S$(0)=“S”. The variable S$(1) is automatically assigned as an empty string. Then, replace a statement such as PRINT“YOU HAVE”N“MISSILES LEFT” with PRINT “YOU HAVE” N “MISSILE”S$ (-(N=1)) “LEFT”.

David Leithauser, 10712 Barnwood Ln., Potomac, MD 20854.

If N is not equal to 1 (say N=3), then N=1 generates a 0, and since S$(0)=“S”, the computer prints “YOU HAVE 3 MISSILES LEFT”. If N=1 the computer generates a -1, which becomes a positive 1 when the computer takes -(N=1). Since S$(1) is an empty string, the computer prints “YOU HAVE 1 MISSILE LEFT”.

For computers in which a true statement generates a 1, such as the Apple II, the expression S$(-(N=1)) should be replaced by S$(N=1). If you do not know what number a true statement generates on your computer, just tell the computer to PRINT 1=1 and see what you get.

For the Atari, which does not have subscripted strings, you can achieve the same result by using this technique to select a substring. Start your program with DIM S$(2):S$=“S ”. Then use S$((N=1)+1,(N=1)+1) instead of S$(N=1).

This technique can be extended to select the proper form for other words in the output. For example, if you have a statement such as PRINT“THERE ARE”;N; “ENEMY SHIPS LEFT” you can start your program (using the TRS-80 as an example again) with DIM S$(1),T$(1): S$(0)=“S”:T$(0)=“ARE”:T$(1)=“IS” and change the output statement to read PRINT“THERE ”;T$(-(N=1));N;“ENEMY SHIP”;S$(-(N=1));“LEFT”.

On the Atari, this would be done by starting the program with DIM S$(2),T$(6):S$=“S ”:T$=“AREIS ” and making the output statement PRINT“THERE ”;T$(3*(N=1)+1,3*(N=1)+3);“ ”;N;“ENEMY SHIP”S$((N=1) +1,(N=1)+1);“LEFT”. END

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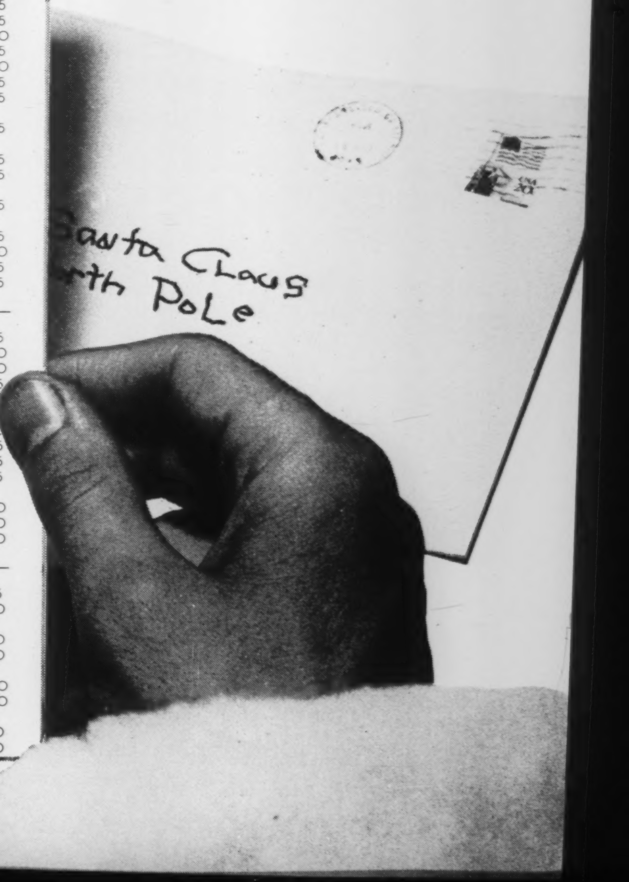

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To Recurse Or Not To Recurse

Edward Grundler

Some programming languages, e.g. Pascal, allow recursion. Recursion is a very powerful technique that is usually misunderstood, if it is understood at all. To compound the problem, recursion is usually taught with bad examples. The purpose of this article is to improve your understanding of recursion and demonstrate its power.

Before we get too far, maybe we should settle on what recursion is. Recursion means to repeat. To use recursion in a program means to enter repeatedly a function or procedure from within the scope of that function or procedure. This brings us to one of the bad examples of recursion.

Consider the program in Listing 1. This and all programs in this article are written in standard Pascal. The function named SUM is a recursive function. Let's examine how it works.

Suppose you enter a 3 for the first value of N. This 3 is passed to the variable I in function SUM. Since I is not equal to 1, the else statement tries to compute SUM := I + SUM (3-1). Now here is the recursive call to SUM. Function SUM must be called to evaluate SUM(2). On this entry to (a new activation of) SUM, I is 2.

Again, since I is not equal to 1, the else statement tries to compute SUM :=I + SUM(2-1). To evaluate SUM(1), a new activation of function SUM is generated and I is assigned the value of 1. Since I is now 1, the value 1 is assigned to SUM. This value is passed to the calling statement and the third activation of function SUM is discarded.

The second activation of SUM can now add 2 to 1 to complete its job. The value 3 is passed to the calling statement, and the second activation of SUM is discarded.

At this point, the first activation of SUM adds 3 to the 3 that was passed to it from the second activation of SUM and passes 6 to the calling statement in the main program. The first activation of SUM is discarded. The main program then writes 6 to the output file and returns to get a new number.

This is a perfectly legal way to find the sum of the first N integers. It is not a very practical or efficient way, however. The program in Listing 2 is a much better way to accomplish the same thing. This solution was included to show that, in general, a problem that can be solved with recursion, can also be solved with simple iteration. Of course, this is also a bad way to solve this particular problem. The program in Listing 3 is the best solution for obtaining the sum of the first N integers.

Another bad example of recursion that frequently shows up in programming classes is finding N! (N factorial) by recursion. N! is defined to be 1 if N is

Listing 1.

```
(INPUT,OUTPUT);

var ANS,N:integer;

function SUM(I:integer):integer;
begin
  if I = 1 then SUM := 1
          else SUM := I + SUM(I - 1)
end;  (*of SUM*)

begin
  repeat
    read(N);
    if N > 0 then
      begin
        ANS := SUM(N);
        writeln(ANS)
      end;
  until (N = 0)
end.
```

Listing 2.

```
(INPUT,OUTPUT);

var ANS,I,N:integer;

begin
  repeat
    read(N);
    if N > 0 then
      begin
        ANS := 0;
        for I := 1 to N do ANS := ANS + I;
        writeln(ANS)
      end;
  until (N = 0)
end.
```

Edward Grundler, 818 East 22nd St., Marysville, CA 95901.

```
(INPUT,OUTPUT);

var ANS,N:integer;

begin
  repeat
    read(N);
    if N > 0 then
      begin
        ANS := N * (N + 1) / 2;
        writeln(ANS)
      end;
  until (N = 0)
end.
```

Listing 3.

```
(INPUT,OUTPUT);

var ANS,N:integer;

function FACT(I:integer):integer;
begin
  if I = 0 then FACT := 1
           else FACT := I + FACT(I - 1)
end; (*of FACT*)

begin
  repeat
    read(N);
    if not(N < 0) then
      begin
        ANS := FACT(N);
        writeln(ANS)
      end;
  until (N = 0)
end.
```

Listing 4.

```
(INPUT,OUTPUT);

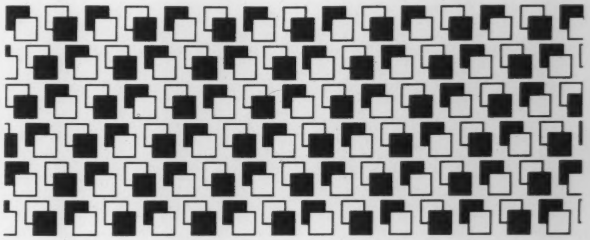
const MAX = 7;

var ANS,N:integer;
    FACT:array[0..MAX] of integer;

procedure INITIALIZE;
var I:integer;
begin
  FACT[0] := 1;
  for I := 1 to MAX do FACT[I] := FACT[I - 1] * I;
end;  (*of INITIALIZE*)

begin
  INITIALIZE;
  repeat
    read(N);
    if not(N < 0) then
      begin
        ANS := FACT[N];
        writeln(ANS)
      end;
  until (N = 0)
end.
```

Listing 5.



0. If N is not 0, then N! = N(N-1)!. Notice that the definition itself is recursive. The program in Listing 4 is the recursive solution. Note the similarity between the programs in Listing 1 and 4.

This is not the best way to handle the factorial problem either. If only a few factorials need to be calculated, the best approach is the method in Listing 2. If many factorials must be calculated during the course of a program, the program in Listing 5 offers the best way. MAX is set to 7 in this example because 8! is beyond the range of most home computers. 8! = 40320. If you have a really big computer, MAX can be made 16 or 17 before the limits of the computer's integer are reached. The point here is that it is much more efficient to compute the small number of values once and keep them in a look-up table.

Sorting

At this point you might be asking if recursion serves any purpose at all. The answer to this question is an emphatic *yes.* The program in Listing 6 uses two recursive procedures that greatly simplify the algorithms that they implement. The program is a sorting routine that sorts integers. In general, any type of data could be stored in the records and any field in the record, other than the pointers, could be used as the sort field.

The program in Listing 6 uses insertion sort to accomplish the sort. In other words, the new data are entered into the list at the proper point as they are entered. This is probably the most natural method of sorting that exists. The main problem with an insertion sort is that if the list is an array or some similar data structure, the list must be opened to do the insertion. To open the list, everything from the point of insertion to the end of the list must be moved.

Figure 1.

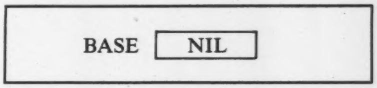
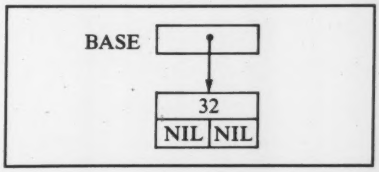


Figure 2.



The program in Listing 6 avoids this problem by using a binary tree as the data structure. With a binary tree, nothing needs to be moved. One only needs to find the proper point in the tree and adjust the necessary pointers.

In program #6, which sorts 20 numbers in a FOR-DO loop, the main program generates a new record and then reads the next number from the input file into the record for that integer (INT) field. Both the left and right pointers are set to NIL and, finally, the record is placed in the tree.

Prior to the first number being entered, the tree appears as in Figure 1. With no data in the tree, its base pointer is set to NIL.

Now let's suppose that the first number entered is a 32. The main program generates a record and calls procedure PLACE, which enters it as the base record. After this occurs, the tree appears as in Figure 2.

```
(input,output);
const MAX = 20;

type INTPTR = ↑INTREC;
     INTREC = record
                INT:integer;
                LEFT,
                RIGHT:INTPTR;
              END;

var BASE,
    PTR:INTPTR;
    I:integer;

procedure PLACE(var ITEM:INTPTR);
begin
  if (ITEM = nil) then ITEM := PTR
  else
    if (PTR↑.INT > ITEM↑.INT) then PLACE(ITEM↑.RIGHT)
    else PLACE(ITEM↑.LEFT);
end;(*OF PLACE*)

procedure TRAVERSE(ITEM:INTPTR);
begin
  if (ITEM↑.LEFT <> nil) then TRAVERSE(ITEM↑.LEFT);
  writeln(ITEM↑.INT);
  if (ITEM↑.RIGHT <> nil then TRAVERSE(ITEM↑.RIGHT);
end;(*OF TRAVERSE*)

begin(*MAIN PROGRAM*)
  readln;
  BASE := nil;
  for I := 1 to MAX do
    begin
      new(PTR);
      read(PTR↑.INT);
      PTR↑.LEFT := nil;
      PTR↑.RIGHT := nil;
      PLACE(BASE);
    end;
  TRAVERSE(BASE);
end.
```

Listing 6.

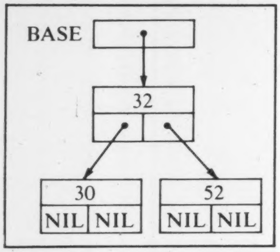


Figure 3.

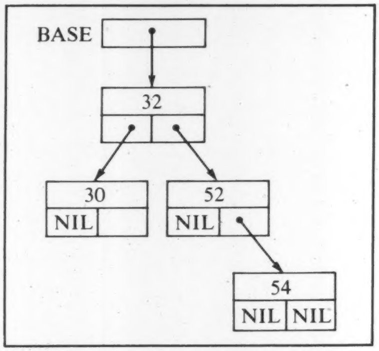


Figure 4.

Procedure Place

With this accomplished, the loop is repeated to get the second number. Suppose it is 52. Again, a record is created and its pointers are set to NIL. This time when procedure PLACE is called, the base record has already been assigned. Instead, PLACE compares 52 with 32 and makes a recursive call to procedure PLACE, pointing to the right subtree of the record containing the 32. If we then enter a 30, the new record is placed in the left subtree of the record containing 32. Our tree now looks like Figure 3.

For the fourth number, let's enter 54. The main program generates a new record and calls procedure PLACE as before. PLACE sees that 54 is larger than 32 and makes a recursive call to procedure PLACE using the right subtree of record 32 as the tree in which to place the new record containing 54.

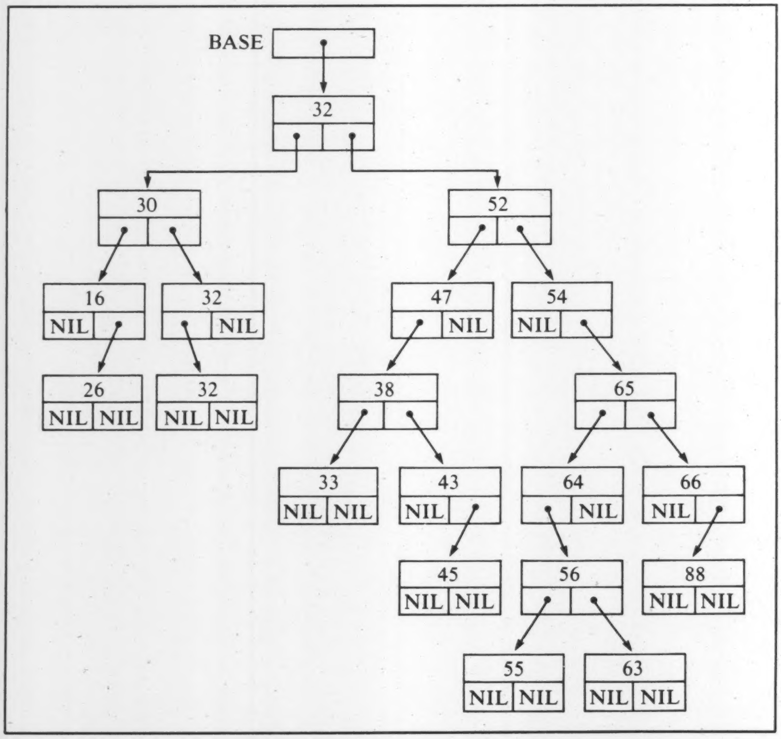
On this call, PLACE compares 54 with 52 and makes a second recursive call to procedure PLACE using the right subtree pointer of the record containing 52. This leaves the tree as shown in Figure 4.

If we continue our entries as follows: 65, 64, 16, 47, 32, 56, 32, 38, 66, 55, 33, 88, 43, 26, 45, 63; we end up with the tree shown in Figure 5. Notice that six levels of recursion are required to place 55 and 63 in the tree.

Procedure Traverse

Since the tree now contains 20 items, the FOR-DO loop is complete, and the main program makes a single call to procedure TRAVERSE to print the entire list.

Figure 5.



Procedure TRAVERSE executes an in-order traverse of the tree and is deceptively simple. As can be seen, the body contains only three statements, two of which are recursive calls to TRAVERSE. The first statement is a recursive call to traverse the left subtree of the current record. The second statement writes the data in the current record. The third statement is a recursive call to traverse the right subtree of the current node.

Following the action of procedure TRAVERSE, we enter looking at the record containing 32 under the base. An immediate call is made to TRAVERSE looking at the record containing 30. Another call is made to TRAVERSE, but this time we are looking at the record containing 16. Since this record has no left subtree, the 16 is sent to the output file and a call to TRAVERSE is made looking at the record containing 26. Since the left subtree of this record is empty, no call to TRAVERSE is made, and the 26 is sent to the output file. Since the right subtree of this record is also empty, a return is made to the call at the record containing 16. We have now completed all action on this record and a return is made to the record containing 30. We can now print the 30 and traverse its right subtree.

> ***For the doubters of the power of recursion in this situation: Try writing a program to place records in a binary tree.***

This action continues until the final item has been printed. The output is printed in the following order: 16, 26, 30, 32, 32, 32, 33, 38, 43, 45, 47, 52, 54, 55, 56, 63, 64, 65, 66, 88.

For the doubters of the power of recursion in this situation: Try writing a program to place records in a binary tree. Do an in-order traverse of the tree without recursion and compare with the single statement in procedure PLACE and the three statements in procedure TRAVERSE.

In summary, if you use a recursive language like Pascal, it would be beneficial to learn how and when to use recursion. After you learn to do sums and factorials in a recursive manner, forget them and concentrate on the beneficial uses of recursion that save time and energy (yours). END

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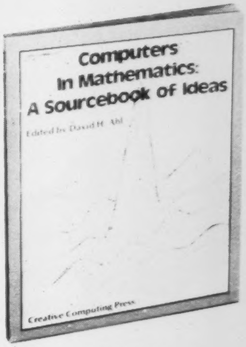

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High Precision Functions In Basic

Part 1

Albert Nijenhuis

Many versions of Basic supply high precision variables and the four operations +, -, *, / for them, but few if any also have high precision versions of SQR, LOG, and similar functions. Some versions of Basic do not supply these functions at all.

Until recently, I gave little thought to these matters, but that changed quite unexpectedly when I tried to duplicate a series of calculations which were supposed to prove that if present trends continue, by the year 2000 the nation's college teachers will have reached the poverty level.

The I/O data were in the range 1000 to 50,000 so I expected no problems with single precision. Still, I could not get a good duplication of the findings, which involved nothing more than a case of fitting data to an exponential curve. At first I looked all over for a cause, but finally realized that I had a "precision problem" when I found that my pocket calculator, which carries about 10 digits, got different results again.

This article and Part 2 show how a few formulas of the calculus, with which many readers are familiar and which others may be willing to accept as given, can rather directly be used to obtain all the functions LOG, EXP, SIN, COS, ASN, ATN, and SQR with high precision.

If you just want a "how" for EXP, SIN, and COS, you may simply copy the programs. In what follows we discuss the "why" for these functions.

The programs have been written on a TRS-80 Model I Level II using double precision and should easily adapt themselves to other situations. This does not hold for the program in Listing 3, which makes fairly heavy use of machine-dependent features.

EXP

To get EXP, we use the infinite series expansion for e^x, which is derived in calculus:

(1)
$e^x = 1 + x/1! + x^2/2! + x^3/3! + \ldots$

Although this is an infinite sum, which would take an infinite amount of time to compute for any given value of x, we can get useful approximations—and that is all we want—by summing a finite number of terms.

In particular, if the values of x are relatively small, a few terms will already give quite good values. This is because the factorials in the denominators increase very rapidly. For example, $3! = 1 \cdot 2 \cdot 3 = 6$, $5! = 120$, $10! = 3.6 \cdot 10^6$, $20! = 2.4 \cdot 10^{18}$.

In the program that we are about to develop, the values for x in (1) will always lie between -0.5 and 0.5. A little experimentation shows that the terms through x^{16} will suffice: $(.5)^{16}/16! = 7.3 \cdot 10^{-19}$; plenty for 16-place accuracy in the calculation of $e^{.5}$ or $e^{-.5}$.

To evaluate the sum through x^{16} we use nested multiplication (also known as Horner's method). To illustrate the idea, here is how you handle the sum through x^4:

$1 + x(1 + x/2(1 + x/3(1 + x/4)))$

with evaluation starting with the innermost parentheses. This method has the advantages of easy programming, no underflow, and minimal round-off error.

The program will require the value of $e = 2.718\ldots$ to full achievable precision. We could copy this from a table, but why not calculate $e^{.5}$ from the formula and square it?

To calculate e^x for arbitrary values of x, determine the integer n so that $-.5 \leq x - n \leq .5$. We then multiply e^{x-n}, obtained from (1), by e^n, obtained by multiplying repeatedly by e (if n is negative, we multiply by 1/e).

Listing 1 shows a Basic program that does these calculations. All variables are double precision except the loop parameters I and N, which are integers.

To obtain good single precision, the loop parameter 16 in line 1310 may be replaced by a smaller value. I found that 9 gave satisfactory results. To test your best=smallest value, experiment: if 9 and 10 give the same result, but 8 does not, then use 9.

SIN and COS

The method to calculate SIN and COS is very similar. In this case we use the infinite series, in which x is expressed in *radian* units:

(2)
$\sin x = x - x^3/3! + x^5/5! - x^7/7! + \ldots$

$\cos x = 1 - x^2/2! + x^4/4! - x^6/6! + \ldots$

The values of x for which we now demand high accuracy lie between $-\pi/4$ and $\pi/4$. By experimentation we find that terms through x^{18} will suffice, because $(\pi/4)^{18}/18! = 2 \cdot 10^{-18}$, again very safe for 16-digit accuracy. Of course, these sums are also computed with the use of nested multiplication.

To calculate sin x or cos x for arbitrary x, first determine an integer n such that $-\pi/4 \leq x - n\pi/2 \leq \pi/4$, and use the formulas to calculate $\sin(x - n\pi/2)$ and $\cos(x - n\pi/2)$. Then use standard trig formulas to find sin x and cos x. For

---

Albert Nijenhuis, Department of Mathematics, University of Pennsylvania, Philadelphia, PA 19104.

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```
1000 ' SUBROUTINE FOR EXP
1010 ' TO INITIALIZE: GOSUB 1100
1020 ' TO CALCULATE:  GOSUB 1200
1030 ' INPUT VARIABLE: X
1040 ' OUTPUT VARIABLE: EX
1050 ' USER-AVAIL CONST: E
1060 ' DBLE PREC: X, EX, E,
1070 ' E1, E2, E3, E4, X1, C1
1080 ' INTEGER: N, I
1090 '
1100 X1=.5: GOSUB 1300
1110 E=C1*C1: E2=C1: E3=1/C1
1120 E4=1/E: RETURN
1130 '
1200 N=INT(X+.5): X1=X-N
1210 GOSUB 1300: EX=C1: E1=E
1220 IF N<0 THEN N=-N: E1=E4
1230 IF N=0 RETURN
1240 IF N/2<>INT(N/2) EX=EX*E1
1250 N=INT(N/2): E1=E1*E1
1260 GOTO 1230
1270 '
1300 C1=1
1310 FOR I=16 TO 1 STEP -1
1320 C1=1+X1*C1/I
1330 NEXT I: RETURN
1340 'END OF  EXP  ROUTINE
'
```

Listing 1.

```
2000 ' SUBROUTINE FOR  SIN, COS
2010 ' TO INITIALIZE: GOSUB 2100
2020 ' TO CALCULATE:  GOSUB 2200
2030 ' INPUT VARIABLE: X
2040 ' OUTPUT VARIABLES: SN, CS
2050 ' USER-AVAIL. CONST: PI
2060 ' DBLE PREC: X, PI, CS, SN,
2070 '       X1, X2, P2, C1, S1
2080 ' INTEGER  N, I, J
2090 '
2100 P2=355D0/226: X1=P2/2
2110 GOSUB 2300
2120 P2=P2+C1*C1-S1*S1
2130 PI=2*P2: RETURN
2140 '
2200 N=INT(X/P2+.5)
2210 X1=X-N*P2: GOSUB 2300
2220 N=N+1-INT(N/4)*4
2230 ON N GOTO 2231,2232,2233,2234
2231 CS=C1: SN=S1: RETURN
2232 CS=-S1: SN=C1: RETURN
2233 CS=-C1: SN=-S1: RETURN
2234 CS=S1: SN=-C1: RETURN
2240 '
2300 X2=X1*X1: C1=1: S1=X1
2310 FOR I=18 TO 2 STEP -2
2320 C1=1-X2*C1/(I*(I-1))
2330 S1=X1-X2*S1/(I*(I+1))
2340 NEXT I: RETURN
2350 'END OF  SIN COS  ROUTINE
'
```

Listing 2.

example $\sin x = \cos(x-\pi/2)$, or $\sin x = -\sin(x-\pi)$. The formula to be used depends on the value of n modulo 4. The value of $n+1$ (mod 4) denotes the quadrant in which $x + \pi/4$ lies.

The accurate value of π that is needed to perform the reductions of the input variable x, can be entered directly as part of the program. There is something interesting to be learned, however, from a calculation by the program. For example, this may raise the question again as to what π actually is, and what radian units (rather than degree measure) are all about.

Figure 1 shows a circle of radius 1, in which an angle AOB of size x has been drawn. Because radian units were used, the length of the arc AB subtended by the angle is exactly x units. Parallel to OA is line DB, where D lies on the line OC perpendicular to OA. As a result, the distance DB is cos x.

We want to calculate the length of the arc ABC, i.e., we want to determine $\pi/2$, thereby, of course, determining π itself. Our basic available tools are algebra and the formulas for sin and cos. Now, if x is not too small, and the angle AOB is acute, then x may be a fairly reasonable estimate of the length of arc ABC. A much better estimate is, however, x + cos x, which is the combined length of arc AB and line segment BD.

All of this may not make too much sense to the casual reader, but there *is* system to this madness. Namely, if going from x to x + cos x gives an improvement in the estimate of $\pi/2$, then applying the same method of improvement again to the number x + cos x will give an even better estimate of $\pi/2$. This process can be repreated as often as we wish.

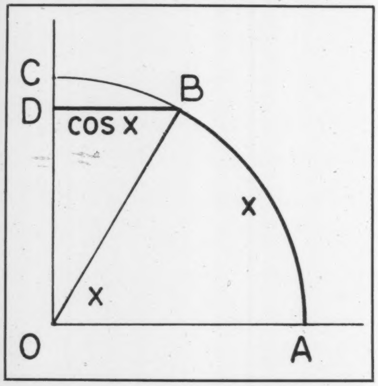

Figure 1.

What is amazing about this all is that, if we start with $x=1$ (not a particularly good approximation for $\pi/2$) and do this improvement business just four times, we have obtained $\pi/2$ with maximum achievable accuracy in double precision!

Equally interesting is that, starting from the approximate value 355/113 of π, just one application of the improvement method gives π to full double precision.

The execution of the scheme must be done with a cos function that takes input x of size up to $\pi/2$, but the finite part of the series that was chosen is accurate only up to $\pi/4$. We therefore use the doubling formula

$$\cos x = \cos^2(x/2) - \sin^2(x/2).$$

This has been included in the program in Listing 2, which calculates sin and cos, in addition to determining π.

For single precision, the value 18 in line 2310 may be reduced by experimentation. The value must, however, be *even* to give meaningful results.

This, then, describes the calculations in this article. In Listing 3 you will find another copy of the combined programs, this time tuned in detail to the TRS-80 Model I Level II. All auxiliary variables start with the same character to simplify the task of avoiding their use elsewhere.

Although I used a V for readability, I recommend an O because of its unpopularity with programmers. It should be possible to MERGE this program with others and thus avoid repeated entry through the keyboard.

The methods to calculate EXP, SIN, and COS shown here are not the fastest known in the trade, but they are simple and quite effective. If you wish to make improvements, there are many things you can do. The single most effective improvement is, of course, to use a compiled language or to code directly in machine language.

Listing 3.

```
5000 CLS: PRINT TAB(6);"HIGH PRECISION
     CALCULATION OF FUNCTIONS"
5010 ' TO INITIALIZE WITH SCREEN
     DISPLAY: GOSUB 5000
5020 ' TO INITIALIZE WITHOUT SCREEN
     DISPLAY: GOSUB 5200
5030 PRINT TAB(16);"INPUT VARIABLE:
     X#": PRINT
5040 PRINT TAB(10);"FUNCTION";TAB(21);
     "GOSUB"; TAB(33);"OUTPUT     VAR":
     PRINT
5050 PRINT TAB(12);"EXP";TAB(22);
     "5300";TAB(35);"EX#"
5070 PRINT TAB(10);" SIN COS";
     TAB(22);"5500"; TAB(33);"SN# CS#"
5110 PRINT: PRINT"USER-AVAILABLE
     CONSTANTS: E#, PI#":PRINT
5120 PRINT"ALL INTERNAL VARIAB START
     WITH 'V': DO NOT USE!"
5130 GOSUB 5200: INPUT"PRESS <ENTER> TO
     CONTINUE";V$: CLS: RETURN
5200 V1#=.5: GOSUB 5350: E#=VA#*VA#:
     VE#=1/E#
5210 VP#=355D0/226: V1#=VP#/2: GOSUB
5550 VP#=VP#+VA#*VA#-VB#*VB#:
     PI#=2*VP#: RETURN
5300 VN%=INT(X#+.5): V1#=X#-VN%: GOSUB
5310: EX#=VA#: RETURN
5310 GOSUB 5350: IF VN%=0 THEN RETURN
     ELSE VJ%=1: V4#=E#: IF VN%<0 THEN
     VN%=-VN%: V4#=VE#
5320 IF VN% AND VJ% THEN VA#=VA#*V4#:
     VN%=VN%-VJ%: IF VN%=0 THEN RETURN
5330 V4#=V4#*V4#: VJ%=2*VJ%: GOTO 5320
5350 VA#=1: FOR VI%=16 TO 1 STEP -1:
     VA#=1+VA#*V1#/VI%: NEXT: RETURN
5500 VN%=INT(X#/VP#+.5):
     V1#=X#-VN%*VP#: GOSUB 5550: ON
     1+(VN% AND 3) GOTO 5510, 5520,
     5530, 5540
5510 CS#=VA#: SN#=VB#: RETURN
5520 CS#=-VB#: SN#=VA#: RETURN
5530 CS#=-VA#: SN#=-VB#: RETURN
5540 CS#=VB#: SN#=-VA#: RETURN
5550 V2#=V1#*V1#: VA#=1: VB#=V1#: FOR
     VI%=18 TO 2 STEP -2:
     VA#=1-V2#*VA#/(VI%*(VI%-1)):
     VB#=V1#-V2#*VB#/(VI%*(VI%+1)):
     NEXT:RETURN
5860 ' END OF HIGH PREC. FUNCT.  EXP,
     SIN, COS
```

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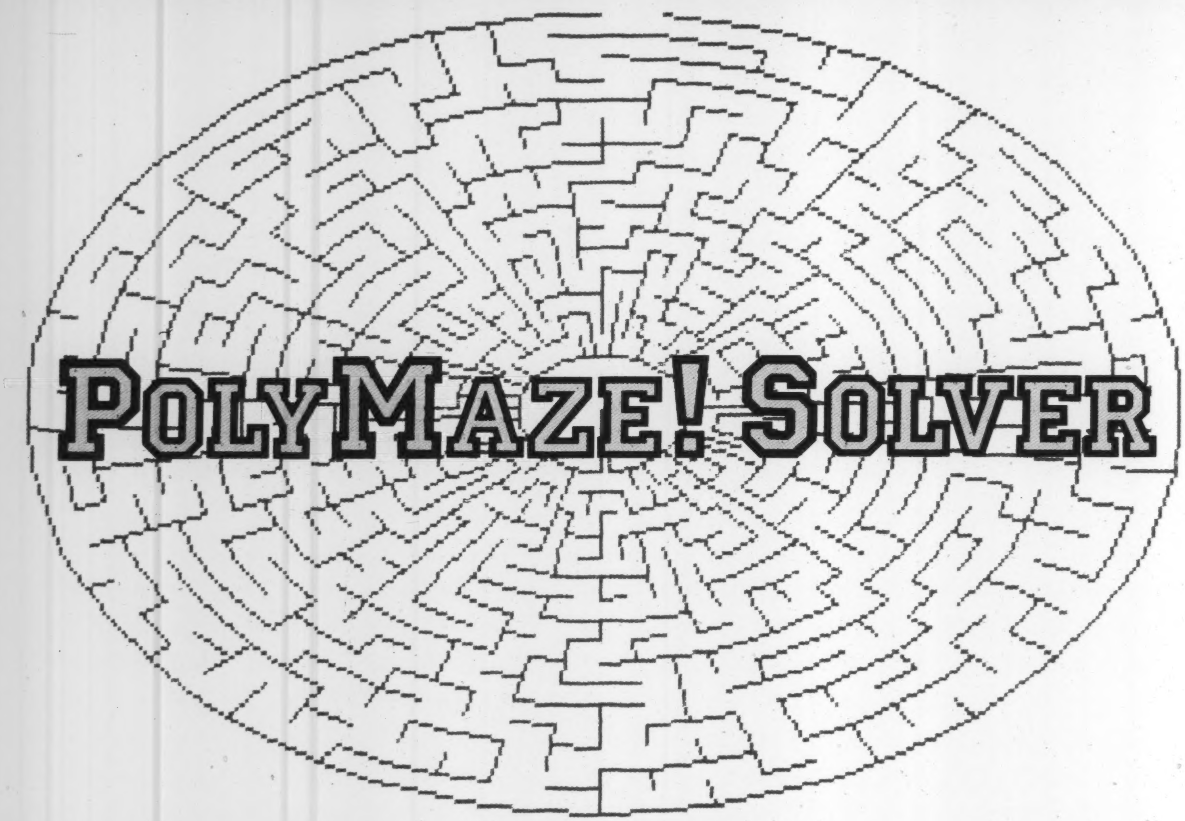

POLYMAZE! SOLVER

Dan Rollins

Programming a computer to generate and solve a maze is more than a fascinating pastime. Maze generation encompasses some of the most basic and important concepts of computer programming. Lists, pointers, two-dimensional arrays, stack structures, binary numbering and logic, simple trigonometry, and the concept of an algorithm are all integral parts of maze programs. In this article I will discuss these subjects and introduce a novel display format and a surprisingly simple method of solving mazes.

A maze aficionado before computers became affordable, I have always enjoyed the challenge of solving mazes. After buying my first computer I found a bigger challenge—programming the computer to create randomly and solve a maze. I have written a maze generator for a pocket computer ("Pocket Computer Fun," *Creative Computing,* December 1982), hexagonal cell mazes, ("Bee Amazed," *Creative Computing,* June 1981), and a fast Z80 machine language maze generator (Kwikmaze," *80 Micro,* November 1982). The common thread through all of these programs is a simple maze-generation algorithm and a bit-oriented method of representing the maze during its creation.

This article presents two programs that demonstrate the maze-generation algorithm. The first, written in standard Microsoft Basic, works on many different types of computers. The other listing creates and solves a maze shaped as a polygon. It is written for the IBM PC and makes use of its advanced graphics features.

Dan Rollins, 134 Olive Suite #C, Glendale, CA 91206.

Maze Generation

I like to think of a maze as a one-floor building with an unusual design. The architect was a bit lazy and decided to make the rooms exactly square and all the same size. After drawing all the rooms, he realized that he had neglected to include any hallways. He quickly inked in a wide door on each of the four sides of every room and went off for a three-martini lunch.

After the building had been constructed, the new owners forced the architect into early retirement, then went about making the best of the situation. They selected certain rooms as offices and sealed three of the doors in those rooms. Certain vice-presidents thought that they should have larger offices, so the doors of some of the rooms were removed to create spacious suites. They then removed the doors of other rooms to create a network of hallways connecting the offices.

The common thread is a simple maze-generation algorithm and a bit-oriented method of representing the maze.

It is easiest to think of maze creation as the process of "opening the doors" to connect various rooms. There is no such thing as a "hall"—only rooms in which two or more doors have been opened to create a passage between more distant rooms.

To generate the maze you simply walk randomly through the building, leaving open the doors by which you enter and leave a

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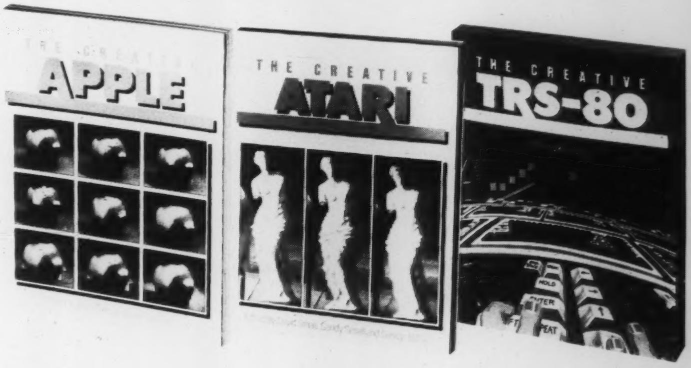

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I like to think of a maze as a one-floor building with an unusual design.

room and sealing off the doors you didn't open. You are likely eventually to reach a position in which all of the possible exits to a room have been sealed off from the other side. To continue, you must return and unseal some doors to find another block of unvisited rooms. You keep track of the number of rooms that you visit and when this total matches the total number of rooms in the building, you know you are finished. This system makes sure that your path doesn't cross itself, thereby ensuring that there is only one direct path between any two rooms. Consequently there is only one solution to the maze, regardless of where you decide to place the entrance and exit.

You can represent the unemployed architect's floor plan as a two-dimensional array. In your random walk through the building, you must keep track of which room you are currently visiting. Your position is represented by a pair of coordinate values, i.e., an X,Y pointer into the array. You move from room to room by adjusting one of these ordinates by either -1 or 1 and leaving the other the same. Use the Y-pointer as a north/south ordinate. Decreasing it by one moves it north. Increasing the Y-pointer moves it toward the south. Increasing and decreasing the X-pointer indicates motion east and west, respectively.

Each array element contains a value that indicates which of its doors are open and which are closed. The array starts with each element being 0, so consider this value to be a room with all the doors closed. As you move through the array, you place values into the elements to indicate which doors you used to enter and leave the room.

One possible method of recording your walk would be to say that if you left the north door open, you set the element to 1. To leave the east door open, add 10. Add 100 for a south door and add 1000 for a west door. Then you need only check the decimal positions to know exactly which of the doors were used. For example, if an array element held a value of 1001, you could see that there must be doors open to the west and to the north.

The decimal method has a major drawback. To test for a particular open door, a time-consuming series of calculations must be performed. Fortunately Basic includes the Boolean logic operator AND which allows quick testing of binary bit positions within an integer value. The AND operator compares the bit-patterns of two operands and returns a value which has bits set that are on in both operands. If you use binary values to indicate the state of the doors of a room, the test for any particular door may be performed quickly and efficiently. When:

north = 0001 binary = 1 decimal
east = 0010 binary = 2 decimal
south = 0100 binary = 4 decimal
west = 1000 binary = 8 decimal

You can open a western door with:

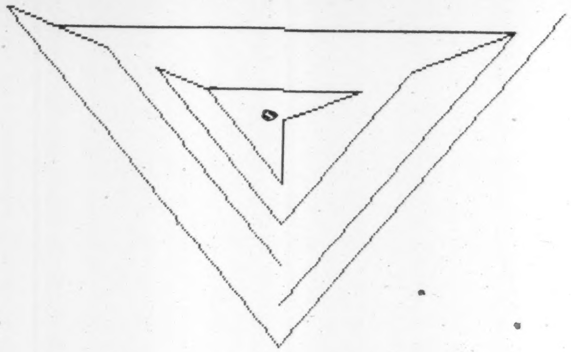
MAZE(X,Y) = MAZE(X,Y) OR 8 'set the West bit = 1

and you can test for a southern door with:

IF MAZE(X,Y) AND 4 THEN . . . 'true when South bit = 1

You end up with each room (array element) as a switch box that holds the YES/NO switches for each of the possible directions.

Given this system of coding the elements of the maze array, you need only create the algorithm to perform the walk-through. The major steps are:



1. Initialize X and Y randomly and set the room count to 0.
2. Check to see if all the rooms have been visited. If so, you are done.
3. Check the rooms to the north, west, south, and east and keep a list of the directions to those rooms that haven't been visited.
4. If there are no adjacent rooms that haven't been visited, scan until a room is found that adjoins an unvisited room (repeat step 3).
5. Choose randomly from among the list of possible directions.
6. Place a value in the current array element to indicate an open door in this direction.
7. Adjust the X,Y pointer to point to the new room.
8. Indicate that the door has been opened in this room also. (If it was entered by moving south, then the north door is now open.)
9. Indicate that another room has been visited (increment the room counter).
10. Go to step 2.

This algorithm is fast and efficient. It yields an array of binary values that represent a maze with only one direct route between any two rooms. Because the binary values are easy to decode, there is much flexibility in the possible methods of displaying and solving the maze.

Listing 1 illustrates this algorithm and shows an example of a simple display subroutine. Some Basics (notably Applesoft) don't support the bit-logic AND operator. This listing actually

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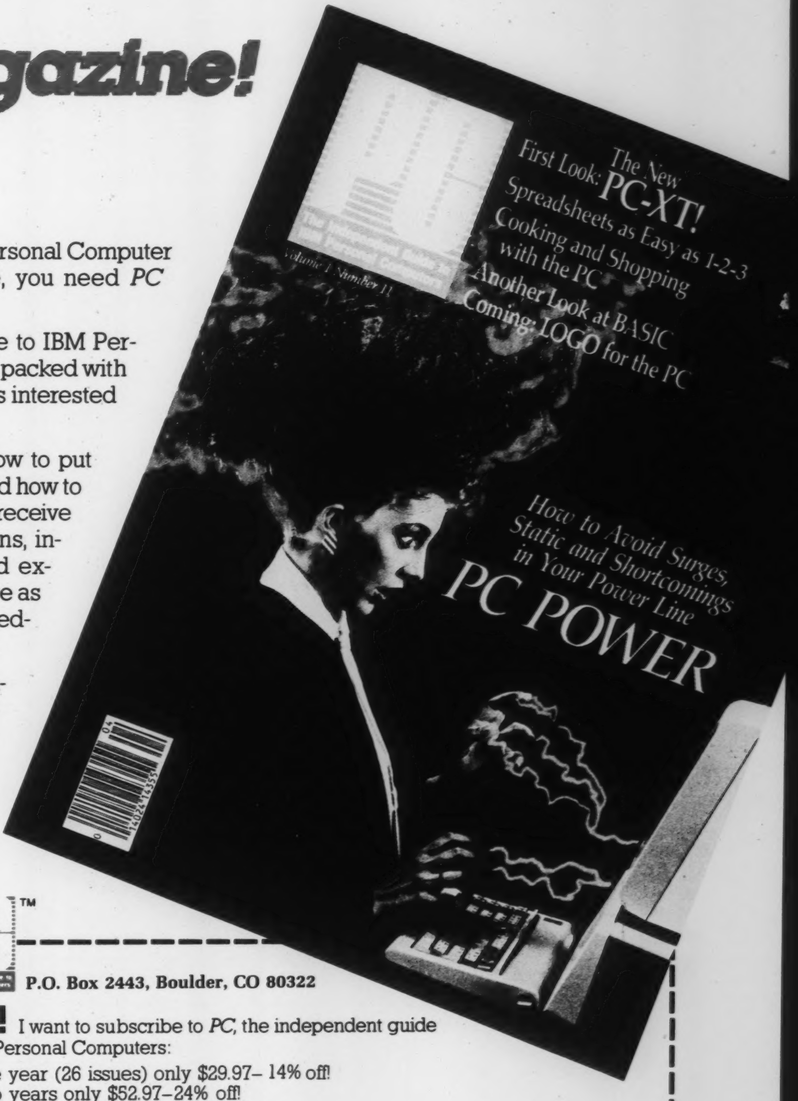
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> **It is easiest to think of maze creation as the process of "opening the doors" to connect various rooms.**

uses the bit-setting scheme we have discussed, but avoids using AND for testing the state of the doors. I suggest that you enter and try modifying this listing. This bare bones maze generator is the foundation of the loftier concepts we are about to discuss. Figure 1 shows the output for Listing 1.

Polymaze

I have always toyed with the idea of creating mazes with unusual shapes. But it wasn't until I got my IBM PC with its wonderful graphics capabilities that I could make the concept a reality.

The idea behind Polymaze is that "rooms" of a maze need not all be identical in shape or size. As long as I could keep a list of the four corners of each room, I could draw lines to connect the corners that made up a wall. Originally, I thought about displaying the maze as a series of concentric circles. Because a circle is simply a polygon with many sides, I came to realize that the idea could be extended to include mazes with any number of sides.

Although the mazes created by Polymaze come in a variety of shapes and complexities, they are all based on the simple maze we have been discussing. Each room has exactly four sides (walls or doors), but the length of the sides varies according to fixed rules.

Figures 2a to 2e illustrate the idea of "stretching" a simple maze into a polygonal maze. Notice that each figure has the same number of vertices and lines and the pattern of the maze is the same for each. The only difference is that the X,Y coordinates for each vertex (the corners of each room) have been recalculated for each figure.

When discussing a square maze, I have referred to the directions of motion as north, east, south, and west. After stretching the maze into a polygon, you can see that these directions are no longer valid (the southern door, for example, may actually face in *any* direction). Therefore, I will hereafter refer to the directions as inward (IN), clockwise (CW), outward (OUT), and counterclockwise (CCW).

Displaying Polymaze

Without going into advanced trigonometry, I will explain the system that Polymaze uses to calculate the corners of each room. Let's start with the twelve points around a clock face that indicate the hour marks. Each mark can be expressed as an X,Y coordinate pair. To find the X (horizontal) ordinate for any hour point, you need to use the SIN function of Basic.

X = SIN(N) expects N to be a value between -π and π. It returns a floating point value for X that would be found somewhere on the perimeter of a circle that has a radius of 1. Given this X, you can multiply it by R, a radius factor, to yield an X ordinate of a circle with radius R.

Because you are trying to locate 12 points around the circle, you need only step N from -π to π in increments of $(2*\pi)/12$ to find the X ordinates of each of the 12 hourly positions. Half of the ordinates will be less than 0, so to center the clock in the middle of the screen, you must add an offset to each X ordinate.

The COS function has a corresponding effect except that it returns a Y (vertical) ordinate. For every X ordinate that is calculated, a matching Y ordinate must also be formed.

```
horizontal size? 20
vertical size  ? 15

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I  I                 I           I     I                 I  I
+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+  +
```

Figure 1. Output of SIMPMAZE.BAS.

You can plot the 12 positions around a radius 50 clock by using the sequence in Listing 2.

Listing 2.

```
10 SCREEN 1,0        '** set to mid resolution graphics

20 PI = 3.14159

30 FOR N = PI TO -PI STEP -(2*PI)/12

40    X = SIN(N) * 50 '** multiply for a radius of 50

50    X = X + 159     '** add horizontal screen offset

60    Y = COS(N) * 50 '** radius factor

70    Y = Y + 99      '** center the circle vertically

80    PSET(X,Y)       '** plot the point

90 NEXT N
```

The points are plotted starting at 12 o'clock and working clockwise around the circle. The same logic would work if you stepped N from 0 to $2*\pi$, except that the points would be calculated starting at the 3 o'clock position.

If you entered and ran the short program in Listing 2, you noticed that the circle was not particularly circular. This is because the IBM screen is wider than it is long. To offset this, you can further modify the X ordinate by scaling it by a screen-correction value. Adding line:

45 X = X + X * 100/320

corrects each point so that the circle appears exactly circular. A

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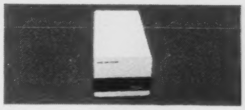

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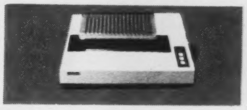

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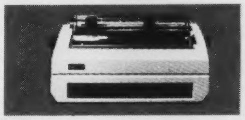

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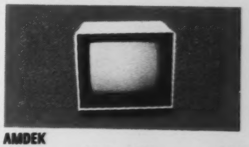

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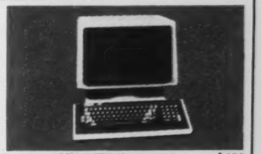

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CIRCLE 169 ON READER SERVICE CARD

Figures 2a-2e. Five states of "stretching" a maze.

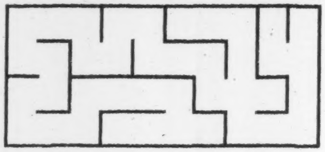

Figure 2a.

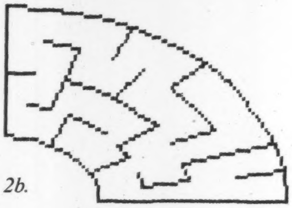

Figure 2b.

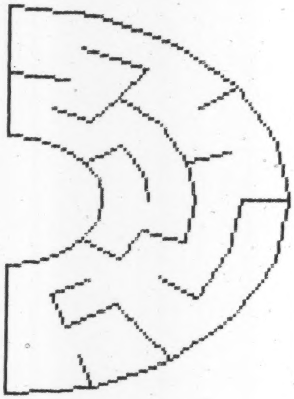

Figure 2c.

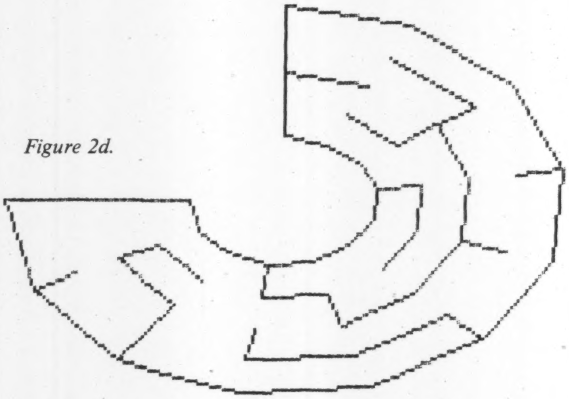

Figure 2d.

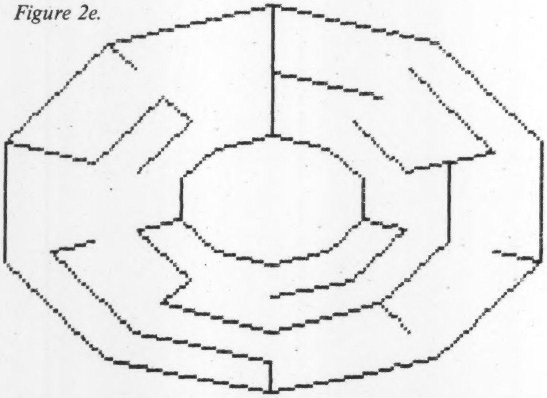

Figure 2e.

> ***Can you design an algorithm that displays a maze so that its rooms are trapezia with sides of random lengths?***

screen-correction factor can be used to scale the circle smaller or larger along either axis. In Polymaze, I chose to stretch the circle along the X-axis so that it fills the screen more completely. I also included a scaling factor that enlarges small mazes to fill the entire screen.

Since you can plot 12 dots around a circle of radius 50, it is easy to see that it is possible to plot any number of dots around a circle of any radius—just by changing the number of divisions around the circle and the radius factor. Finally, you need not simply plot the dots. You can save each coordinate pair in an array then later use them as endpoints for the lines that will make up the walls of the rooms of the maze.

Polymaze calculates the X,Y pairs that make up a polygon for each of the concentric levels of the maze. A room is defined by four endpoints. These are the endpoints of the two lines defined by a polygon edge at one level and the corresponding edge one level inward. Given a vertex and level pointer, (X and Y for simplicity), the points that define a room are:

(X,Y) = outer counterclockwise corner
(X+1,Y) = inner counterclockwise corner
(X,Y+1) = outer clockwise corner
(X+1,Y+1) = inner clockwise corner

The exception to the rule is when you are referencing the highest numbered vertex of any level. It connects with the points of vertex 0.

If you connect these points, you have a trapezium with the inner line shorter than the outer line—an upside down lamp shade.

By examining your previously generated maze, you can determine which of the corners need to be connected, i.e., if the maze arrow indicates that there is an open door, don't draw the line. Therefore, displaying the maze is a simple matter of looping through each of the levels and each of the vertices and drawing the lines indicated by the bit patterns in the maze array.

Given a maze generated by the algorithm we discussed, displaying it as a polygonal figure is simply a matter of determining the endpoints and drawing the necessary lines. The work is all in the display part of the program. However, there is one minor difference in the maze generation algorithm for polygonal mazes. Rooms that are on the easternmost side of a normal square maze have been stretched around until they are directly adjacent to the rooms on the westernmost side. The algorithm must be modified to allow doors to be created that connect these two extremes.

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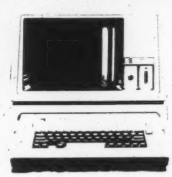

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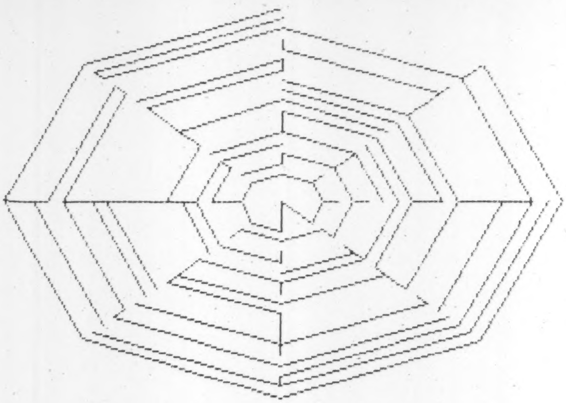
The effect of the paint sweeping through the maze is startling and delightful.

If you compare lines 1000-1220 of Listings 1 and 3, you will note that the only major difference is the inclusion of lines 1070 and 1080 in the Polymaze listing. These do a check to see if the "wrap-around" is possible and add the direction to the list if so. Also line 1130 makes the wrap-around adjustment when the move crosses this boundary.

Before a discussion of the maze solution routine, I would like to present a challenge to skilled programmers. Remembering that the rooms of a maze don't need to be the same size or shape, can you design an algorithm that displays a maze so that its rooms are trapezia with sides of random lengths? The only constraints are that lines (walls) of an individual room don't cross each other and that every wall or door is wide enough to clearly delineate an edge of the room; i.e., never to have two endpoints so close together that they appear as one. This seems to be the ultimate in randomized mazes.

Solving The Maze

Lines 4000-4320 of Listing 3 allow you to work your way manually through the polymaze by pressing the cursor control keys. The only trick is to remember that the arrow keys are redefined from "move up, right, down, or left" to mean "move outward, clockwise, inward, and counterclockwise." To indicate your current position, the program uses the dramatic PAINT command. This is seen again in the "razzle-dazzle" routine starting at line 6000. The effect of the paint sweeping through the maze is startling and delightful. It also gave me the clue to an unusually simple algorithm that solves mazes.



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CIRCLE 263 ON READER SERVICE CARD

If you use the Ctrl-NumLock sequence to pause the progress of the PAINT command, you can see that PAINT is actually solving the maze! Starting the paint at the exit to the maze, it works its way eventually to the entrance. It may take detours into cul-de-sacs (dead ends), but it very quickly finds its way to the outer top vertex.

The IBM PC Basic manual states that you might need to CLEAR extra stack-space memory if you use the PAINT command on complex shapes (I found that a compiled version of Polymaze required this). The clue is that PAINT is a stack-oriented command. It apparently paints left and right until it reaches a border color. When there is a choice of moving either up or down, it saves its current position on the stack and continues painting left and right going down. When it can't continue, it POPs its most recent decision point off the stack and continues up from there. When it meets a dead-end and finds that there is no decision point to POP, it has completed its function.

That PAINT was solving my maze was interesting. I let it smolder at the back of my mind for a while as I wrote the cursor control routines. At one point I was moving through a very complex maze (60 vertices by 18 levels), and I found fingerprints all over my monitor screen. I had been placing my finger at decision points so that I could trace around the maze and return if my choice had been a false lead. It occurred to me that I could give the player a useful tool to aid in manually solving the maze. It has been included in Listing 3 as the save and retrieve command.

While you manually solve the maze, you can press S to save the current position. Pressing R restores the values that were most recently saved, putting the cursor in the room where you most recently pressed S. You can save your position more than once—the program remembers the position of each of the rooms where you pressed S. These positions are all available, but they may only be accessed sequentially backward from the most recently saved room.

Thus, saved rooms are placed in a stack, but just like a stack of books, you can only reach the book that is on the top of the pile. After taking the top book off, there is a new book on the top so it becomes available.

There it was again—a stack-oriented procedure. The two clues came together, and I sat down and formulated the algorithm for solving a maze. The goal is to end up with a list of all the rooms that must be traversed to go from the entrance to the exit of the maze. This I call the solution list. I needed a

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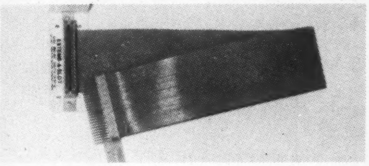

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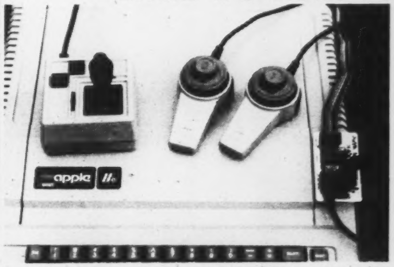

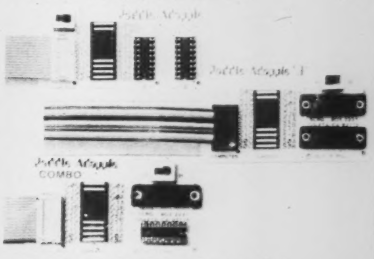

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stack structure to hold not only the coordinates of a room but the direction of entry and the count of the number of rooms in the solution list.

Here is the maze solving procedure I came up with:

1. Initialize an empty stack structure to hold room coordinates, direction, and the solution list pointer.
2. Initialize an X,Y pointer to the entrance and a direction value.
3. Enter a room in the current direction. Save this position in the solution list.
4. If the position is the exit, then the solution is complete.
5. For each door in a room, save the coordinates of the room it connects with, the direction by which it would be entered, and a count of the number of rooms that are in the solution list. In other words, PUSH the relevant data on the stack.

The beauty of this algorithm is that no special work needs to be done for special situations.

6. Retrieve the data from the top of the stack. This moves the X,Y pointer into a new room and updates the direction and the solution list count. This step POPs data from the stack.
7. Go to step 3.

The beauty of this algorithm is that no special work needs to be done for special situations. Regardless of the number of open doors in a room, the program does the same thing.

The most common situation is that a room has only two doors. Since we entered by one, the data for the other door (the only exit) are the only values PUSHed. They are immediately POPped in the next step.

When there are three or more doors (two or three possible exits), a decision point has been reached. We simply PUSH both (or all three) sets of data onto the stack and immediately POP one back off.

When a room has only one open door (a cul-de-sac), no data are PUSHed onto the stack. So the next POP returns the data from the route that was not taken at the most recent decision point. Since the solution list counter is part of the data on the stack, it is restored with the POP. This means that all of the rooms that were saved in the solution list between the last decision point and the POP are abandoned. They obviously didn't lead to the exit of the maze so they shouldn't be included in the solution list.

Figure 3 and its caption illustrate this algorithm for a simple maze. The same logic is used to solve a polymaze.

As you see in Listing 3 (lines 5000-5140), the maze solving routine is very short and simple. The subroutines starting at lines 5500 and 5600 handle the PUSH and POP functions. The subroutine at line 5700 is called whenever a new room is entered. It displays the current position to give you a graphic demonstration of the solution algorithm.

There is one tricky bit of coding that might seem peculiar. When a new room is entered, the program must "look" in three directions to see which doors are open. The four directional values are the same as used in the maze generation routines, i.e., 0 = OUT, 1 = CW, 2 = IN, 3 = CCW. These numbers correspond to the power of 2 that defines an open door in the same direction. So to check if there is a door in direction 3, the program could AND the room value with 2 ↑ 3, i.e., 8. But this would force the computer to do a time-consuming transcendental function—exponentiation. So I have defined a four-element list to hold these values. The computer needs only to look up the value in the list.

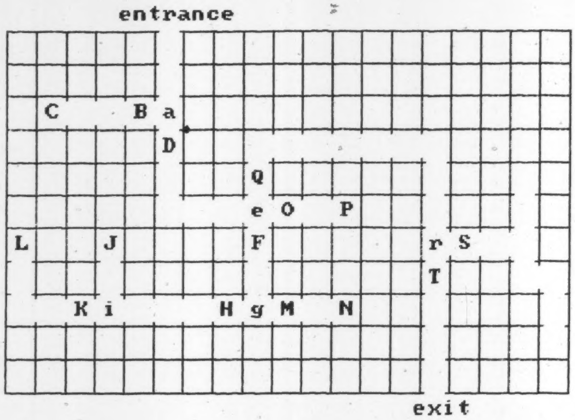

Figure 3. Illustration of maze-solving algorithm. This figure illustrates the Polymaze stack-oriented maze-solving algorithm. As a pointer is moved through the maze, the coordinates of the current room are saved in a solution list and data for each adjoining room are PUSHed onto the stack. The saved data consist of the coordinates of the room, the current value of a "solution list pointer" and the direction of the open door.

After the data for each adjoining room are PUSHed, one set of data is POPped. When there is only one adjoining room (aside from the room just vacated), the pointer always advances to that room.

In this illustration, lowercase letters indicate rooms where a decision is made. Starting at the entrance, the pointer proceeds to room a. Rooms D and B are pushed onto the stack, then room B is immediately POPped. The pointer advances to room C which is a cul-de-sac. No data are PUSHed, so the POP results in the advance of the pointer to room D. Note that the rooms between (and including) B and C are removed from the solution list when the data associated with room D are POPped—the solution list pointer points back to when they had not yet been saved.

At room e, rooms Q, O, and F are PUSHed and F is POPped. The stack keeps growing until room J is reached. At that time, K is POPped and the pointer proceeds to room L. This continues until after room Q is POPped and the stack is temporarily empty. The solution list now contains only the rooms that directly connect the entrance to room Q.

When the exit is finally reached, room S (and any other unresolved decisions) remain harmlessly on the stack, and the solution list contains a sequential record of each of the rooms that must be traversed to go from entrance to exit.

Try thinking in binary and cycling through that equation six times. You will see the desired pattern emerge.

Now to "rotate" the direction so it points to each door in turn, I could say:

DIR = DIR+1 :IF DIR=4 THEN LET DIR = 0

But a quad-state pointer can be very quickly rotated with:

DIR = (DIR+1) AND 3

This uses the arithmetic function form of the AND command. Try thinking in binary and cycling through that equation six

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PolyMaze! Solver, continued...

times. You will see the desired pattern emerge. The same logic can be used to cycle the pointer in the opposite direction, i.e., 3 2 1 0 3 2 . . . instead of 0 1 2 3 0 1 . . . Use:

```
DIR = (DIR-1) AND 3
```

Playing With Polymaze

The Polymaze program in Listing 3 requires an IBM PC with the color graphics card and BasicA. You can use a monochrome monitor like the NEC Character Display but not the IBM monochrome monitor. You will enjoy the program more with a color monitor.

Polymaze offers a menu with three options. The first option asks you for the size of the maze you want. It then generates and draws a maze and allows you to try to solve it. The maze is displayed in white lines. Your current position is displayed at each step by filling in the current room with blue and by blinking the walls of the room. Use the cursor control keypad to move. For complex mazes, you might want to use the S and R keys as an aid to finding the solution. When you reach the center (the maze exit), the program does a little razzle-dazzle then returns to the main menu.

The second option allows you to watch the solution algorithm in action. The maze is created and displayed, then the computer solves the maze and displays the most direct path. The program asks you to press any key and you are returned to the main menu.

It should be easy to expand this program to make it into a race game or the basis for a labyrinth adventure.

The final option turns your computer screen into a fascinating display. It continually draws mazes of random sizes and displays them in random colors. Pressing any key returns you to the main menu.

The subroutines used in Polymaze are well defined and fully commented. It should be easy to expand this program to make it into a race game or the basis for a labyrinth adventure.

Summary

The programs and discussions presented here have covered much territory. The maze generating and solving subroutines are algorithms—step by step procedures to perform a desired task. We talked about one-dimensional lists and two-dimensional arrays and how to access the data in each of the array elements.

The maze data are in the form of binary numbers—each bit indicating the open or closed condition of one of four doors in a room. We talked about how to set the values to indicate the state of the doors and how to test the bits to determine that state.

The discussion on displaying a simple maze in the form of a polygon included some rudimentary trigonometry and topology. We had to use SIN and COS to calculate the four endpoints that would define the corners of each room, and we saw how the topology of a simple maze can be "stretched" into the shape of a polygon.

We talked about the concept of a stack and how it is used in this application to aid in the process of making decisions. By stacking the decision point data and retrieving that data upon discovering that the wrong decision was made, we found a way to make a very complex decision—the solution to a maze. END apple discount software

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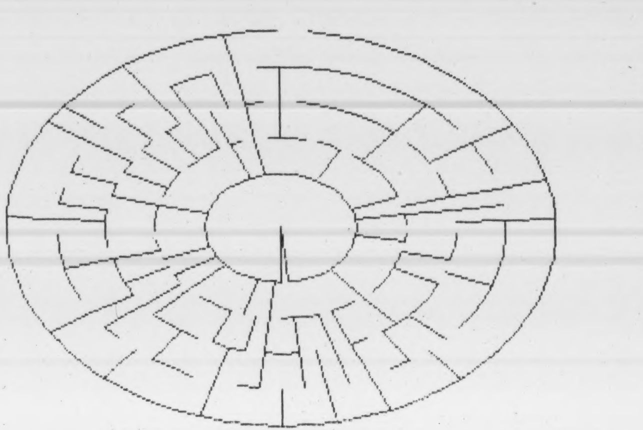
CIRCLE 126 ON READER SERVICE CARD

Listing 1. SIMPMAZE.BAS.

```
1 '**                    SIMPMAZE.BAS
2 '**       Generic Maze Generator by Dan Rollins, 04/05/83
3 '**   Generates a simple maze.  Uses standard Microsoft BASIC.
10 DEFINT A-Z
20 DIM T(5), MZ(100,100)   '** maze array (may be expanded to memory size)
30 DIM YD(3),XD(3)  :YD(0)=-1 :XD(1)=1 :YD(2)=1 :XD(3)=-1
40 DIM PWR2(3)       :PWR2(0)=1 :PWR2(1)=2 :PWR2(2)=4 :PWR2(3)=8
50 RANDOMIZE                         '** set a random seed
100 INPUT "horizontal size";H
110 INPUT "vertical size  ";V
120 H=H-1 :V=V-1                    '** figure-in 0th elements
130 X=INT(RND*H) :Y=INT(RND*V)  '** random starting point
140 GOSUB 1000                      '** generate the maze
150 MZ(0,0)=MZ(0,0)+1               '** open a North door for maze entrance
160 GOSUB 2000                      '** print the maze
170 GOTO 100
996 '**        ---- Maze generation subroutine ----
997 '** expects: TR=total rooms, H=horizontal max, V=vertical max
998 '**            XD(dir), YD(dir) = motion vectors, PWR2( ) = powers of 2
999 '**
1000 FOR J=0 TO H :FOR K=0 TO V :MZ(J,K)=0 :NEXT :NEXT '** "close" all doors
1010 RC=0 :TR=(H+1)*(V+1)-1        '** initialize Room Count, Total Rooms
1019 '** ---- Main maze generation loop ---- **
1020 Q=0 :IF RC = TR THEN RETURN   '** if Room Count = Total Rooms then done
1030   IF Y>0 THEN IF MZ(X,Y-1)=0 THEN Q=Q+1 :T(Q)=0        '** North
1040   IF X<H THEN IF MZ(X+1,Y)=0 THEN Q=Q+1 :T(Q)=1        '** East
1050   IF Y<V THEN IF MZ(X,Y+1)=0 THEN Q=Q+1 :T(Q)=2        '** South
1060   IF X>0 THEN IF MZ(X-1,Y)=0 THEN Q=Q+1 :T(Q)=3        '** West
1090   IF Q=0 GOTO 1200                                     '** no move
1098   '** open the doors and move into new room       ^
1099   '**
1100   D=INT(RND*Q)+1 :DIR=T(D)                '** choose randomly from list
1110   MZ(X,Y)=MZ(X,Y) + PWR2(DIR)             '** add door in current room
1120   Y=Y+YD(DIR) :X=X+XD(DIR)                '** move to new room
1130   ND=DIR-2 :IF ND<0 THEN ND=4+ND          '** opposite DIR for New Dir
1140   MZ(X,Y)=MZ(X,Y) + PWR2(ND)              '** add door in new room
1150   RC=RC+1                                 '** update Room Count
1160 GOTO 1020
1199   '** Trapped! Scan for an unvisited room.
1200   Y=Y+1 :IF Y>V THEN Y=0 :X=X+1 :IF X>H THEN X=0
1210   IF MZ(X,Y)=0 THEN 1200         '** if empty keep scanning, else....
1220 GOTO 1020                        '** see if neighbor has been visited
1996 '**   ---- subroutine prints the maze ----
1997 '**   only checks for North and West doors
1998 '** change all PRINTs to LPRINTs for hardcopy
2000 CLS
2010 FOR Y=0 TO V
2020   FOR X=0 TO H
2030     IF INT(MZ(X,Y)/2)=MZ(X,Y)/2 THEN PRINT "+--"; :GOTO 2050
2040     PRINT "+  ";                          '** must have a North door
2050   NEXT X  :PRINT "+"
2060   FOR X=0 TO H
2070     IF MZ(X,Y) > 7 THEN PRINT"   "; :GOTO 2090   '** must be a West door
2080     PRINT"I  ";
2090   NEXT X  :PRINT "I"
2100 NEXT Y
2110 FOR X=0 TO H-1        '** add the bottom line
2120   PRINT"+--";
2130 NEXT X :PRINT "+  +"  '** maze exit in Southwest corner
2140 RETURN
```



Listing 3. POLYMAZE.BAS.

```
1 '**                  POLYMAZE.BAS
2 '**                 by Dan Rollins
3 '**                    04/05/83
4 '**
5 '**    Requires IBM-PC, color/graphics, BASICA
6 '**
7 '**       Draws and solves polygonal mazes
8 '**
10 DEFINT A-Z
20 DIM MZ(61,18), T(5)
30 DIM CIR.SIN!(61),CIR.COS!(61), XC(61,18),YC(61,18)
40 DIM STACK(1000),SOLUTION.LIST(1,1000)
50 DIM Y.DELTA(3), X.DELTA(3)
60  Y.DELTA(0)=-1 :X.DELTA(1)=1 :Y.DELTA(2)=1 :X.DELTA(3)=-1
70 DIM PWR2(3)
80  PWR2(0)=1 :PWR2(1)=2 :PWR2(2)=4 :PWR2(3)=8
90  LA$=CHR$(0)+CHR$(75) :RA$=CHR$(0)+CHR$(77)   '** arrow keys for
100 UA$=CHR$(0)+CHR$(72) :DA$=CHR$(0)+CHR$(80)   '**   manual solving
110 FALSE = 0 :TRUE = NOT FALSE
120 RANDOMIZE VAL(RIGHT$(TIME$,2))               '** create a random seed
130 DEF FN CENTER.X=INT((XC(X,Y)+XC(X+1,Y+1))/2) '** center of room X,Y
140 DEF FN CENTER.Y=INT((YC(X,Y)+YC(X+1,Y+1))/2) '**  for PAINT command
197 '**
198 '** PolyMaze menu
199 '**
200 SCREEN 1,0 :COLOR 0,1 :CLS :KEY OFF
210 PRINT TAB(16) "PolyMaze"
220 PRINT TAB(13) "by Dan Rollins"
230 PRINT :PRINT:PRINT "options:"
240 PRINT :PRINT TAB(8) "1) You solve the maze."
```

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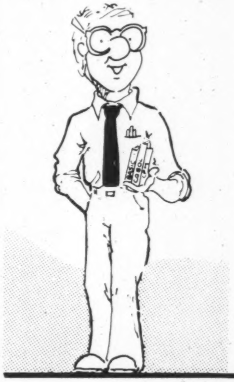

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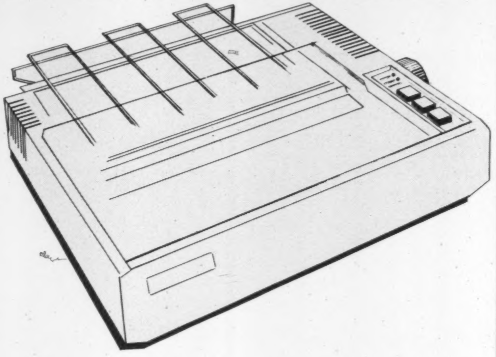
Listing 3, continued.

```
250 PRINT :PRINT TAB(8) "2) Computer solves the maze."
260 PRINT :PRINT TAB(8) "3) Random maze display."
270 PRINT :PRINT :PRINT TAB(8) "0) Quit"
280 LOCATE 23,1 :INPUT "Your choice";OPT$
290 OPT = VAL(OPT$)
300 IF OPT <0 OR OPT > 3 THEN BEEP :GOTO 280
310 CLS :ON OPT GOTO 400,410,600
320 SCREEN 0,0,0,0 :WIDTH 80 :END               '** option 0, Quit
400 PRINT "You solve the maze" :GOTO 420
410 PRINT "Computer solves the maze"
420 PRINT :PRINT :INPUT "Number of vertices (3 to 61)";H
430 IF H<3 OR H>61 THEN BEEP :GOTO 420
440 PRINT :PRINT :INPUT "Number of levels   (2 to 18)";V
450 IF V<2 OR V>18 THEN BEEP :GOTO 440
460 H=H-1 :V=V-1                            '** include the 0th element
470 CLS :GOSUB 1000                         '** generate the maze
480 EX=INT(H/2) :MZ(EX,V)=MZ(EX,V) OR 4     '** place maze exit
490 GOSUB 2000                              '** calculate the corner points
500 GOSUB 3000                              '** display the maze
510 IF OPT=2 THEN GOSUB 5000 :GOTO 200      '** computer solves the maze
520 GOSUB 4000                              '** player solves the maze
530 GOSUB 6000                              '** colorful wrap-up
540 LOCATE 1,1 :PRINT "press any";
550 LOCATE 2,1 :PRINT "key"
560 WHILE INKEY$="" :WEND :GOTO 200         '** back to menu
597 '**
598 '**       random generate and display loop
599 '**
600 H=INT(RND*58)+3 :V=INT(RND*15)+3 :EX=INT(H/2)
610   GOSUB 1000 :MZ(EX,V)=MZ(EX,V) OR 4
620   GOSUB 2000 :CLS :GOSUB 6000
630   IF INKEY$ <> "" THEN GOTO 200         '** any key to get to menu
640 GOTO 600
993 '**
994 '**    ---- Maze generation subroutine ----
995 '** expects: H=horizontal size (number of polygon edges)
996 '**          V=vertical size (number of levels)
997 '**          X.DELTA(dir), Y.DELTA(dir) = motion vectors for 4 directions
998 '**          PWR2( ) = powers of 2 ie, 1,2,4,8
999 '**
1000 FOR J=0 TO H :FOR K=0 TO V :MZ(J,K)=0 :NEXT :NEXT '** "close" all doors
1010 RC=0 :TR=(H+1)*(V+1)-1 :X=INT(RND*H) :Y=INT(RND*V)
1014 LOCATE 1,1 :PRINT"generating"; :LOCATE 2,1 :PRINT "the maze:";
1016 LOCATE 25,1 :PRINT TR;"to go";
1018 '**
1019 '** ---- Main maze generation loop ---- **
1020 Q=0 :IF RC = TR THEN RETURN   '** if Room Count = Total Rooms then done
1030    IF Y>0 THEN IF MZ(X,Y-1)=0 THEN Q=Q+1 :T(Q)=0        '** OUT
1040    IF X<H THEN IF MZ(X+1,Y)=0 THEN Q=Q+1 :T(Q)=1        '** CW
1050    IF Y<V THEN IF MZ(X,Y+1)=0 THEN Q=Q+1 :T(Q)=2        '** IN
1060    IF X>0 THEN IF MZ(X-1,Y)=0 THEN Q=Q+1 :T(Q)=3        '** CCW
1070    IF X=0 THEN IF MZ(H,Y)=0   THEN Q=Q+1 :T(Q)=3        '** CCW
1080    IF X=H THEN IF MZ(0,Y)=0   THEN Q=Q+1 :T(Q)=1        '** CW
1090    IF Q=0 GOTO 1200                                     '** no move
1097    '**
1098    '** open the doors and move into new room
1099    '**
1100    D=INT(RND*Q)+1 :DIR=T(D)                  '** choose randomly from list
1110    MZ(X,Y)=MZ(X,Y) OR PWR2(DIR)              '** door in current room
1120    Y=Y+Y.DELTA(DIR) :X=X+X.DELTA(DIR)        '** move to new room
1130    IF X>H THEN X=0 ELSE IF X<0 THEN X=H
1140    MZ(X,Y)=MZ(X,Y) OR PWR2((DIR+2) AND 3)  '** door in new room
1150    RC=RC+1
1160    LOCATE 25,1 :PRINT TR-RC;                 '** display count
1170 GOTO 1020
1197    '**
1198    '** Trapped! Scan for unvisited room neighboring visited room.
1199    '**
1200    Y=Y+1 :IF Y>V THEN Y=0 :X=X+1 :IF X>H THEN X=0
1210    IF MZ(X,Y)=0 THEN 1200          '** if empty, keep scanning, else....
1220 GOTO 1020                          '** see if neighbor has been visited
1230 '** ------------------------------------------------------------------
1996 '**
1997 '** subroutine calculates the points of the corners of each room
1998 '** expects: H,V are horizontal,vertical sizes
1999 '**
2000 LOCATE 1,1 :PRINT "calculating"; :LOCATE 2,1 :PRINT "corners  ";
2010 Z=-1 :PI!=3.14159  :XY.ADJ!=1.603015   '** adjustment for x,y screen size
2020 FOR J!=PI! TO -PI! STEP -2*PI!/(H+1)
2030    Z=Z+1
2040    CIR.SIN!(Z)=SIN(J!)        '** avoid repeated use of
2050    CIR.COS!(Z)=COS(J!)        '** transcendental functions
2060 NEXT
2070 SCALE!=(17/(V+1))*7.5         '** factor enlarges small mazes
2080 FOR Y=0 TO V+1
2090    RADIUS=(V+1-Y)*SCALE!+30   '** 30 minimum radius
2100    FOR X=0 TO H
2110      XC(X,Y)= CIR.SIN!(X) * RADIUS + 159
2120      YC(X,Y)=(CIR.COS!(X) * RADIUS + 159)/XY.ADJ!
2130    NEXT
2140    XC(H+1,Y)=XC(0,Y) :YC(H+1,Y)=YC(0,Y) '** link edges
2150 NEXT
2160 RETURN
2997 '**
2998 '** draw the maze (spiral from outside to inside)
2999 '**
3000 SCREEN 1 :COLOR 0,1 :CLS :KEY OFF
3010 FOR Y=0 TO V
3020    FOR X=0 TO H
3030      C=3 :GOSUB 9000       '** draw room with doors
3040    NEXT
3050 NEXT
3060 LINE (159,99)-(XC(EX,V+1),YC(EX,V+1)),3      '** inverted "V" at maze exit
3070 LINE (159,99)-(XC(EX+1,V+1),YC(EX+1,V+1)),3
3080 RETURN
3997 '**
3998 '** subroutine for player to solve the maze
3999 '**
4000  X=0 :Y=0 :SP=0 :DONE=FALSE             '** start in room 0,0
4010  C=2 :GOSUB 9100                        '** outline current room w/o doors
4020  PAINT (FN CENTER.X,FN CENTER.Y),2,2 '** paint current room blue
4030  C=0 :GOSUB 9100                        '** outline in black w/o doors
4040  C=3 :GOSUB 9000                        '** draw room with doors (white)
4050  GOSUB 4200                             '** make a move (returns TX and TY)
4060  IF TX=X AND TY=Y THEN C=0 :GOSUB 9000 :GOTO 4040 '** no move, blink walls
4070  C=0 :GOSUB 9100                       '** outline room in black
4080  PAINT(FN CENTER.X,FN CENTER.Y),0,0 '** paint room black (leave the room)
4090  C=3 :GOSUB 9000                       '** redraw room as before (with doors)
4100  X=TX :Y=TY                            '** adjust to point to new room
4110 IF NOT DONE THEN 4010                  '** repeat until finished
```

```
4120 RETURN                          '<-- return when at maze exit -----------
4197 '**
4198 '** get a Key, determine if valid move, alter TX,TY if so
4199 '**
4200 TX=X :TY=Y
4210 K$=INKEY$ :IF K$="" THEN RETURN
4220 IF K$=LA$ THEN IF MZ(X,Y) AND 8 THEN TX=X-1 :GOTO 4300
4230 IF K$=RA$ THEN IF MZ(X,Y) AND 2 THEN TX=X+1 :GOTO 4300
4240 IF K$=UA$ THEN IF MZ(X,Y) AND 1 THEN TY=Y-1 :GOTO 4300
4250 IF K$=DA$ THEN IF MZ(X,Y) AND 4 THEN TY=Y+1 :GOTO 4300
4260 IF K$<>"S" AND K$<>"s" THEN 4280
4270 STACK(SP)=X :STACK(SP+1)=Y :SP=SP+2 :RETURN      '** [S] to Save position
4280 IF K$<>"R" AND K$<>"r" THEN RETURN
4285 IF SP=0 THEN BEEP :RETURN                        '** stack is empty!
4290 SP=SP-1 :TY=STACK(SP) :SP=SP-1 :TX=STACK(SP):RETURN '** [R] to Retrieve
4297 '**
4298 '** adjust for connection of edges and test for finished
4299 '**
4300 IF TX>H THEN TX=0 ELSE IF TX<0 THEN TX=H
4310 IF TY > V  THEN DONE = TRUE
4320 RETURN
4997 '**
4998 '**  computer solves the maze
4999 '**
5000 SP=0 :SLPTR=0               '** init Stack Pointer, Solution List PoinTeR
5010 LOCATE 1,1 :PRINT"solving";
5020 X=0 :Y=0 :DIR=0            '** starting room, starting DIRection
5030 WHILE X<>EX OR Y<>V        '** do until at maze exit
5040   T.DIR=(DIR+1) AND 3      '** turn one notch
5050   WHILE T.DIR <> DIR       '** do until back at starting direction
5059                            '** if there's an open door in this direction,
5060     IF (MZ(X,Y) AND PWR2(T.DIR)) > 0 THEN GOSUB 5500       '** then PUSH
5070     T.DIR=(T.DIR+1) AND 3  '** look to the next direction
5080   WEND                     '**  until all directions examined
5090   GOSUB 5600               '** POP data from stack
5100   SOLUTION.LIST(0,SLPTR)=X  '** store current room in solution list
5110   SOLUTION.LIST(1,SLPTR)=Y
5120   GOSUB 5700               '** paint the current room blue
5130   GOSUB 5800               '** restore room to normal
5140 WEND
5197   '**
5198   '** The maze is solved.  Display each room of the solution.
5199   '**
5200 LOCATE 1,1 :PRINT"solution:";
5210 FOR J=0 TO SLPTR
5220   X=SOLUTION.LIST(0,J) :Y=SOLUTION.LIST(1,J)
5230    GOSUB 5700
5240 NEXT
5250 LOCATE 24,1 :PRINT"Press"; :LOCATE 25,1 :PRINT"any Key";
5260 WHILE INKEY$="" :WEND
5270 RETURN
5497 '**
5498 '** PUSH data of "decision room" onto the stack
5499 '**
5500 TX=X+X.DELTA(T.DIR) :IF TX>H THEN TX=0 ELSE IF TX<0 THEN TX=H
5510 TY=Y+Y.DELTA(T.DIR) :IF TY>V THEN TY=0 ELSE IF TY<0 THEN TY=V
5520            STACK(SP) = TX
5530 SP=SP+1 :STACK(SP) = TY
5540 SP=SP+1 :STACK(SP) = (T.DIR+2) AND 3
5550 SP=SP+1 :STACK(SP) = SLPTR + 1
5560 SP=SP+1
```

```
5570 RETURN
5597 '**
5598 '** POP the data from the stack
5599 '**
5600 SP=SP-1 :SLPTR = STACK(SP)
5610 SP=SP-1 :DIR   = STACK(SP)
5620 SP=SP-1 :Y     = STACK(SP)
5630 SP=SP-1 :X     = STACK(SP)
5640 RETURN
5697   '**
5698   '** routine paints the current room BLUE (displays position)
5699   '**
5700 C=2 :GOSUB 9100
5710 PAINT (FN CENTER.X,FN CENTER.Y),2,2
5720 C=3 :GOSUB 9000
5730 RETURN
5797   '**
5798   '** routine paints the room BLACK (return to normal)
5799   '**
5800 C=0 :GOSUB 9100
5810 PAINT (FN CENTER.X,FN CENTER.Y),0,0
5820 C=3 :GOSUB 9000
5830 RETURN
5997 '**
5998 '** colorful wrap-up.  PAINTs maze various colors
5999 '**
6000 GOSUB 3010                  '** redraw the lines so paint won't escape
6010 X=EX :Y=V                   '** set up X,Y for FN calls
6020 FOR C=0 TO 1
6030   COLOR 0,C
6040   PAINT (FN CENTER.X,FN CENTER.Y)  ,C+1,3
6050   PAINT (FN CENTER.X,FN CENTER.Y)  ,0,3
6060 NEXT
6070 C1=0 :COLOR 0,0                            '** spiral alternating colors
6080 FOR Y=0 TO V
6090  FOR X=H TO 0 STEP -1
6100   C=3 :GOSUB 9100                          '** draw w/o doors
6110   PAINT (FN CENTER.X,FN CENTER.Y),C1,3
6120   C1=C1+1: IF C1=4 THEN C1=0
6130 NEXT :NEXT
6140 RETURN
8997 '**
8998 '** subroutine draws room (X,Y) with doors
8999 '**
9000 IF (MZ(X,Y) AND 1)=1 THEN 9020
9010  LINE (XC(X,Y),YC(X,Y))-(XC(X+1,Y),YC(X+1,Y)),C
9020 IF (MZ(X,Y) AND 8)=8 THEN 9040
9030  LINE(XC(X,Y),YC(X,Y))-(XC(X,Y+1),YC(X,Y+1)),C
9040 IF (MZ(X,Y) AND 4)=4 THEN 9060
9050  LINE (XC(X,Y+1),YC(X,Y+1))-(XC(X+1,Y+1),YC(X+1,Y+1)),C
9060 IF (MZ(X,Y) AND 2)=2 THEN 9080
9070  LINE(XC(X+1,Y),YC(X+1,Y))-(XC(X+1,Y+1),YC(X+1,Y+1)),C
9080 RETURN
9097 '**
9098 '** subroutine draws the room without doors (color C)
9099 '**
9100 LINE (XC(X,Y),YC(X,Y))-(XC(X+1,Y),YC(X+1,Y)),C
9110 LINE -(XC(X+1,Y+1),YC(X+1,Y+1)),C
9120 LINE -(XC(X,Y+1),YC(X,Y+1)),C
9130 LINE -(XC(X,Y),YC(X,Y)),C
9140 RETURN
```



Print About Printers

This month we review one of the most compact full-width printers available and look at some alternatives to an expensive printer stand.

David H. Ahl

Inforunner Riteman Printer

While leafing through one of the personal computing magazines, we spotted an ad which boasted, "The first 10" printer you can fit into your briefcase." That sounded pretty attractive, so we obtained a Riteman for evaluation.

Over the past year or so, we have noticed that printers have been getting smaller and smaller, and on occasion we have carried around an Epson MX-80 (14.5" x 12" x 5"), Gemini Star 10 (15" x 12" x 5"), or Mannesmann Tally Spirit 80 (15" x 13" x 5"). Notice that all of them have about the same dimensions—compact, but if you put one in a briefcase there is little room for much else.

However, the Riteman measures only 14" x 10.6" x 3", small enough to fit in a briefcase with room to spare for a Model 100 and some papers or magazines. The weight is only 11 pounds. These dimensions are for the friction/pin feed version of the printer; adding the tractor feeder produces an awkward center lump with a height of 4.6".

Alternative Feed Mechanisms

In the slim/trim configuration, the Riteman has a friction feed roller for single sheets. It is no joy to load, but patience and practice makes the process go more smoothly.

At both ends of the platen are pin feed rollers for use with continuous forms. On our test sample, the width of the pin feeders could be varied only from 9.4" to 10.2". This was designed for use with standard European and Japanese 10" (actually $9^7/_8$") wide fan fold paper. We understand from the manufacturer that production models for the U.S. will have a 9" pin feed mechanism for use with standard $9^1/_2$" paper (which tears down to $8^1/_2$" x 11").

For handling non-standard size paper, labels, or narrow forms, an optional tractor feeder is available. It is designed to handle forms of any width from 4" to 10", and it does an admirable job. The tractor feeder is easily mounted and removed by simply raising and lowering two tractor locking levers on either side of the feeder. The tractor feeder comes with its own print cover which hinges at the front of the printer.

Inforunner Riteman printer on the Standard from Kensington Microware.

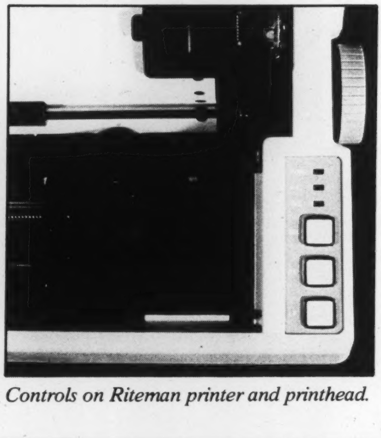
Cassette Ribbon

The ribbon for the Riteman is enclosed in a compact cassette which fits over the moving printhead. It is easily installed and not at all messy. Only a fabric ribbon is available, and, at least at the current time, replacement ribbons must be obtained directly from the manufacturer. Information on ribbon life is not available.

Controls and Connectors

The top panel of the printer has the expected three control buttons (On Line/Off Line, Form Feed, and Line Feed) and three LED indicators (Power On, Printer On Line, and Paper Out).

On the right side in front of the platen is a lever which adjusts the gap between the printer head and platen. For one or two copies, a narrow gap should be selected, while for three or four copies, a wide gap would be selected.



Controls on Riteman printer and printhead.

FORM LENGTH
SEL
PAPER
POWER
TOF SET
SEL
FORM FEED
LINE FEED
OKIDATA
μ 92
microline

THE PERSONAL PRINTER BUILT LIKE A SHERMAN TANK PERFORMS LIKE A CONCERT GRAND.

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The STX-80 printer for Christmas '83!

What a great gift idea!

It's the STX-80 printer from Star. Sleek, compact and priced under $200, it's sure to put you in a very giving mood.

The STX-80 prints whisper-quiet printouts. It features true descenders, foreign language characters and special symbols. It offers both finely detailed dot addressable and block graphics.

And you can give it with confidence knowing that it can run with virtually every type of personal and business computer.

The STX-80 printer from Star. It's the perfect gift for every computer user in your life. Especially if one of them happens to be you!

Enjoy your presents and have a happy and healthy holiday.

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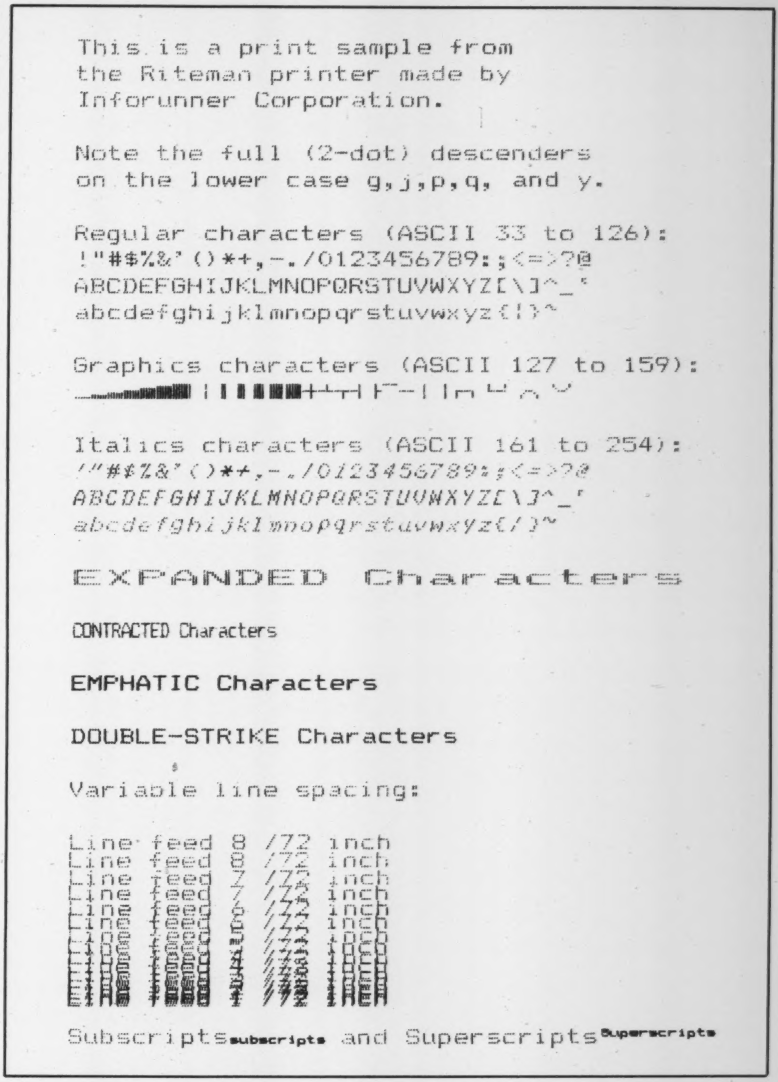
Happy Holidays!
stx-80

Print About Printers, continued...



```
This is a print sample from
the Riteman printer made by
Inforunner Corporation.

Note the full (2-dot) descenders
on the lower case g,j,p,q, and y.

Regular characters (ASCII 33 to 126):
!"#$%&'()*+,-./0123456789:;<=>?@
ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`
abcdefghijklmnopqrstuvwxyz{|}~

Graphics characters (ASCII 127 to 159):

Italics characters (ASCII 161 to 254):
!"#$%&'()*+,-./0123456789:;<=>?@
ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`
abcdefghijklmnopqrstuvwxyz{|}~

EXPANDED Characters

CONTRACTED Characters

EMPHATIC Characters

DOUBLE-STRIKE Characters

Variable line spacing:

Line feed 8 /72 inch
Line feed 8 /72 inch
Line feed 7 /72 inch
Line feed 7 /72 inch
Line feed 6 /72 inch

Subscripts subscripts and Superscripts Superscripts
```

Figure 1. Character set and print samples from the Riteman printer.

Twelve DIP switches are accessible behind a plastic cover in the rear of the printer. These control such things as linefeed (lines per inch), printing mode (normal or bold), bell sound (on or off), slashed zero, auto feed (on or off), skip perforation (on or off), and selection of international character set (USA, France, UK, or Germany).

Also on the rear are the power cord connector and 36-pin male Centronics connector. A rocker power switch is on the right side of the unit.

Print Protocol and Speed

The Riteman uses a standard Centronics parallel protocol and recognizes all of the standard control codes such as carriage return, linefeed, form feed, horizontal tab, busy, signal acknowledge, select, and printer initialize. The "special" control codes are the same as those used on Epson printers, which are becoming more-or-less standard in the industry.

For example, the printer recognizes 34 special control codes to produce double-width, condensed, emphasized, bold, italics, and full graphics characters. The character set and some of these print modes are shown in Figure 1.

In addition, control codes can be used to select various paper feed settings, page lengths, underline, subscripts, superscripts, right margin, and one-way printing (instead of the normal bi-directional printing).

The printer has three dot-addressable graphics modes. Single density has 480 printable positions on an 8" line, while double density has 960 positions. A mode with 576 print positions produces a true 1:1 dot ratio which enables the Riteman to produce perfect squares, circles, and other geometric figures.

Normal print speed of the Riteman is claimed to be 120 characters per second, or 60 cps with enlarged or condensed characters.

Print Method

The Riteman uses a 5 x 9 dot matrix for producing characters. This print format means that normal lowercase letters have two-dot descenders and are very readable. For some curious reason, lowercase italics letters use only a one-dot descender and the tops of the g, j, q, p, and y are one dot higher than the other lowercase letters (see Figure 1).

The 32 built-in graphics characters use a 6 x 9 dot matrix; thus they butt against one another when printed on a line. By using a 7/72" vertical line spacing, graphics characters will also butt against one another in a vertical direction.

Various print modes (expanded, condensed, etc.) are selected by means of control codes. In a Basic program such codes can be sent by CHR$(n). Several of the examples in the printer manual assume a version of Basic that permits hexadecimal numbers in the argument of the CHR$ function, i.e., CHR$(&H14) for hex 14. Most Basics do not accept this format and require a decimal argument such as CHR$(20).

Documentation

As with so many computers and peripherals today, the documentation is the weak point in an otherwise excellent product. Admittedly, the 80-page manual is better than many, but it is a far cry from the outstanding 200-page tutorial manual supplied with Epson printers.

The Riteman manual is excellent in the sections on unpacking and setting up. However, it begins to fall short in the use of control codes. In its favor, we should note that examples are given to demonstrate most of the features. Three short graphics examples are included, but we get no clue how to reproduce a hi-res graphics image from, say, an Apple computer.

The Last Line

We were very impressed with the small size, many features, and admirable performance of the Riteman. Its simplic-

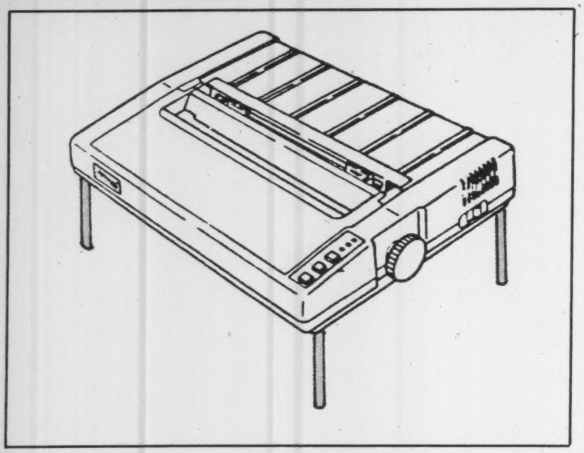


Figure 2. Printer on el cheapo home-brew dowel stand.

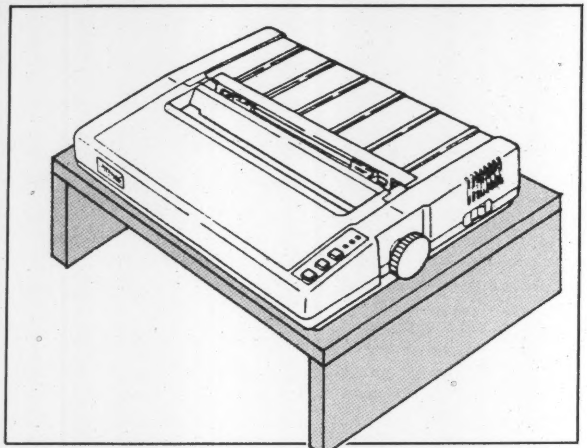


Figure 3. Printer on stand built from 1" pine.

ity of design should result in good reliability. We were disappointed in the documentation which falls short in several areas. However, at the suggested list price of $499 (tractor feeder $40), the Riteman printer is a good value, and should find favor with the executive on the move.

We have also heard that Star Micronics will market this model as the Gemini 10X, and in that incarnation will include redrawn documentation and the ability to handle standard paper sizes.

Printer Stands

Although we generally prefer to place our printers on roll-around printer carts that have room on a lower shelf for a full box of paper, this may not always be convenient. If you do have the room, we particularly like the stands from FineTech (P.O. Box 280, Woodbury, TN 37190), American Innovations (10428 Product Dr., Rockford, IL 61111), and System Furniture (P.O. Box 427, Lafayette, OR 97127).

However, if your printer is sitting on a table or desk, it is a problem knowing what to do with the paper. Do you put it on the floor which tends to lead to dirty and torn paper? Or do you put it on the table behind the printer so the printed output can jam the paper feeding in? In this situation, we feel the best solution is to raise the printer a few inches above the surface of the table with either a commercial or home-brew stand.

Typical of the commercial stands is the Standard from Kensington Microware. It is 16" wide x 14" deep x 3" high. A larger size for 132-column printers is 23.5" wide. It is constructed of an attractive smoky acrylic plastic.

With a stand, the paper is stored under the printer, which saves space and protects the paper against dust and dirt. Furthermore, proper paper feed is ensured, eliminating tears and jams. We found it necessary to allow about 0.5" between the paper stack and the top of the stand, particularly with heavier (20#) paper.

Suggested list price of the small Standard is $49.95. The manufacturer is Kensington Microware, 919 Third Ave., New York, NY 10022.

Home-Brew Stands

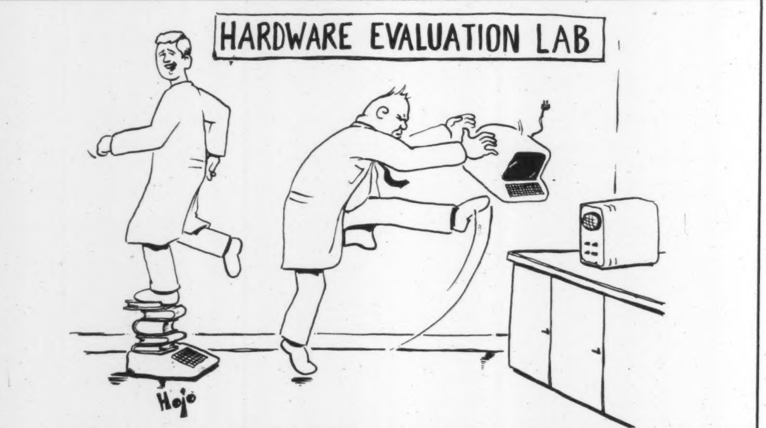
The all-time cheapest home-brew stand for some, but not all printers is made of four short pieces of dowel. Some printers such as the Epson and Riteman have recessed screws on the bottom near the four corners. The holes in the case into which these screws are recessed are usually about $\frac{1}{4}$" or $\frac{3}{8}$" in diameter.

Get a dowel rod just slightly larger than the holes. Cut four $3\frac{1}{2}$" pieces and sand one end so that it fits tightly into the hole in the printer base. Be sure the printer rests evenly on all four legs. Even when everything is balanced correctly, the printer will tend to "walk" on a table top and you may wish to put rubber or felt feet on the bottom of each dowel.

A much more satisfactory stand for only a little more money can be made from a piece of 1" pine board. You will need a piece of nominal 12" width (actually $11\frac{1}{4}$") board two feet in length, two 2" angles, and some screws and nails.

Cut two pieces of board $4\frac{1}{2}$" wide for the side uprights; this will leave a piece 15" long for the top. Attach the top to the sides with finishing nails. Since printers tend to rock from side to side, screw an angle bracket to the top and each side on the inside.

You can spruce up the appearance with a coat of stain and polyurethane finish. Total cost, about $3.00 and a half hour of work. END

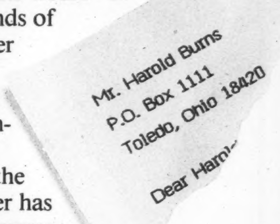


"Gosh, simulating normal wear and tear certainly is an exacting procedure."

THE BUFFER DID IT.

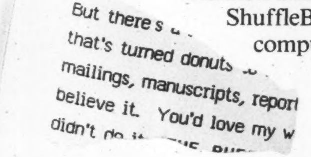
Who Stole The 1500 Letters From The Computer?

Let's just say you've got to send a letter to 1500 different people. Would you like to spend 22.5 hours* or 60 seconds of computer time?


Mr. Harold Burns
P.O. Box 1111
Toledo, Ohio 18420
Dear Harol

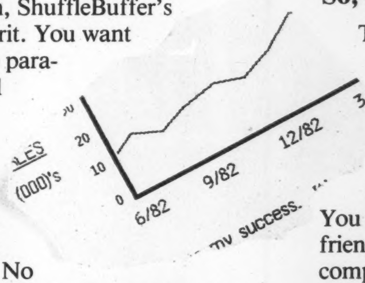
With a garden-variety buffer, the computer has to mix, merge and send 1500 addresses and 1500 letters to the buffer. Trouble is, most buffers only store about 32 letters. So after 32 letters, the computer's down until the printer's done. Altogether, you're talking 22.5 hours.

In the case of our new (not to mention amazing) ShuffleBuffer, computer time is 60 seconds flat. Just give ShuffleBuffer one form letter and your address list, and it takes care of the mixing, the merging, and the printing. But that's not all ShuffleBuffer's stolen from the computer. Oh, no.


But there's
that's turned donuts
mailings, manuscripts, report
believe it. You'd love my w
didn't do it

Who Changed and Rearranged The Facts?

Again, ShuffleBuffer's the culprit. You want to move paragraph #1 down where #3 is? Want to add a chart or picture? No problem. No mystery, either. Any buffer can give you FIFO, basic first-in, first-out printing. And some buffers offer By-Pass; the ability to interrupt long jobs for short ones. But only ShuffleBuffer has what we call Random Access Printing — the brains to move stored information around on its way to the printer. Something only a computer could do before. Comes in especially handy if you do lots of printing. Or lengthy manuscripts. Or voluminous green and white spread sheets. And by the way, ShuffleBuffer does store up to 128K of information and gives you a By-Pass mode, too.


SALES
(000)'s
30
20
10
0
6/82
9/82
12/82
3/
my success.

And Who Spilled The Beans 239 Times?

Most buffers can't tell the printer to duplicate. If they can, they only offer a start/stop switch, which means you're the one who has to count to 239. Turn your back on your buffer, and your printer might shoot out a room full of copies. ShuffleBuffer, however, *does* control quantity. Tell it the amount, and it counts the copies. By itself.

So, What's The Catch?

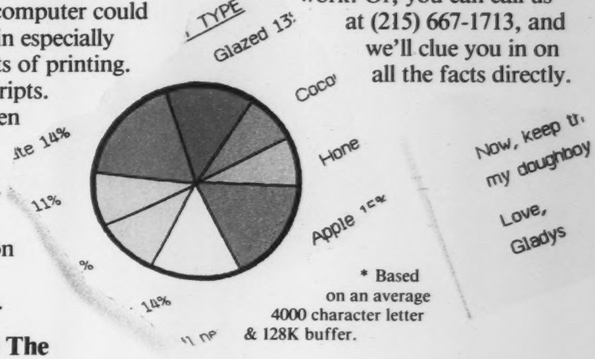
There isn't any. Sleuth around. You won't find another buffer that's as slick a character as this one. You also won't find one that's friendly with any parallel or serial computer/printer combination. This is the world's only universal buffer.

With a brain.

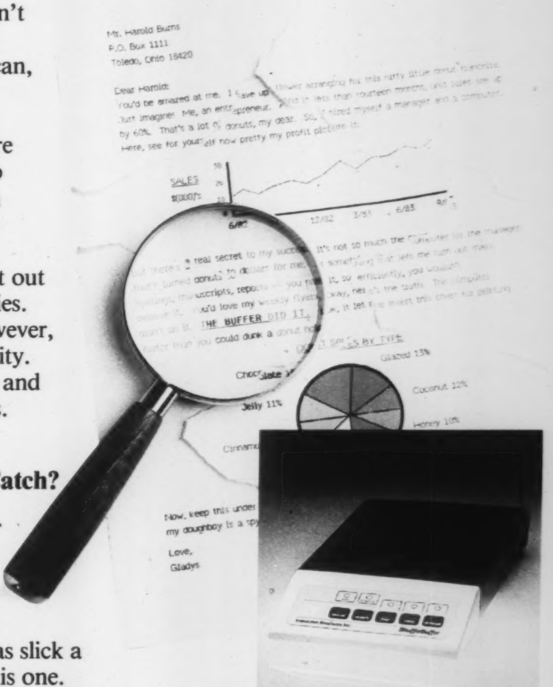
CIRCLE 179 ON READER SERVICE CARD

Who Wants You To Catch A ShuffleBuffer In Action?

You guessed it. We do. Just go to your local computer dealer and ask him to show you a ShuffleBuffer at work. Or, you can call us at (215) 667-1713, and we'll clue you in on all the facts directly.


TYPE
Glazed 13
Coco
Hone
Apple 15%
te 14%
11%
%
14%
Now, keep th
my doughboy
Love,
Gladys

* Based on an average 4000 character letter & 128K buffer.


Mr. Harold Burns
P.O. Box 1111
Toledo, Ohio 18420
Dear Harold:
SALES
6/82
12/82
3/83
6/83
THE BUFFER DID IT.
SALES BY TYPE
Glazed 13%
Coconut 22%
Jelly 11%
Honey 10%
Now, keep this under
my doughboy is a spy
Love,
Gladys
ShuffleBuffer

ShuffleBuffer
The Buffer with a Brain

Interactive Structures Inc.
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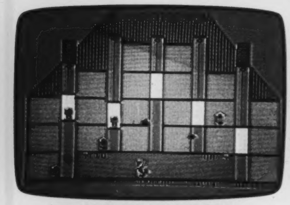
Atari VCS 2600



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Starring Peter the Painter
Designed by Fernando Herrera
Atari Home Computers
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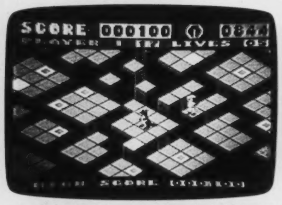
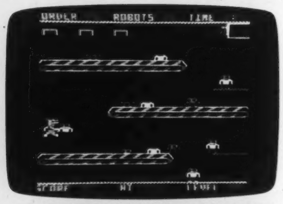


FLIP and FLOP™

Designed by Jim Nangano
Atari Home Computers
Commodore Computers



PANIC BUTTON™

TRS-80 Color Computer
by Paul Kanevsky
Vic-20 Home Computer
by Wayne Lam

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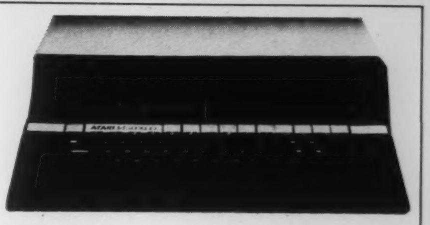


Outpost: Atari

Arthur Leyenberger

Welcome back to the Outpost. It doesn't seem like too long since we last talked. There is a great deal to cover this month and, since it is the holiday season, I will offer a few gift ideas for your consideration. But first, bear with me while I attempt to clear the air.

Most Atari computer owners already know that their machines are competitive in features and capability with just about any other "home" micro. We know that the Atari is a serious machine disguised in game clothing. There are over ten programming languages (not counting dialects) that may run on an Atari. The sound and graphics are superior to machines costing thousands more. The machines are very friendly: sound and graphics do not require POKE statements; full screen editing makes learning Basic hassle-free; and such features as AUTORUN files and instant Basic syntax error-checking make life easier all around.

The problem is that most non-Atari users are unaware of these facts. When I demonstrate word processing, spreadsheet, database and other application software to the uninitiated, I see their reactions. The most common expression I hear is, "You mean the Atari can do all that? And play games too? Wow!"

Ignorance of the capabilities of the Atari is not limited to consumers. Much of the popular press perpetuates the idea that the Atari can *only* play games, and should not be considered for much else. I was recently very disappointed to see *Consumer Reports,* of all publications, perpetuating this myth in their long-awaited September 1983 special home computer issue.

In their discussion of the Atari 800 computer, one of the drawbacks mentioned was Atari's version of Basic. They said it is "less desirable than the versions used in most other computers." No mention was made of the instant syntax checking or the full screen editing capability of the Atari. These two features are a boon to the novice programmer. They speed the learning process and make programming much easier.

Next, the documentation is degraded. *Consumers* says the Basic manuals are only fair. Fair at what? The Basic manual is a reference manual, not a tutorial. When I teach Atari Basic programming, the first thing I tell my students is to go out and buy the Osborne/McGraw-Hill book, *Your Atari Computer* by Lon Poole, et. al. This is an excellent Atari reference book—the best. Still, a good text, and probably a good teacher, is required to learn to program.

Finally, *Consumers* says that the Atari cannot be used as an inexpensive word processor. They mention the disk-based *Bank Street Writer* which requires a disk drive. Then they say you also have to buy a printer, as if you can do word processing on other computers without a printer. Let's leave the printer out of it for now. The cartridge-based *Atariwriter* word processor has been out for six months, is as easy to use as the *Bank Street Writer,* and allows data to be saved on a cassette recorder. It brings word processing to the masses.

I have always respected the judgment of *Consumer Reports.* I would not think of taking one small consumer step toward purchasing any product without first consulting them. But the problem here is indicative of a much larger issue. That is, treating computers as appliances or any other consumer product. Sure, the machines are sold as consumer products, but the amount of effort required to operate a computer and use application software is far greater than that required to use a toaster or an automobile.

I can understand how a *Consumer Reports* staff reviewer might have taken an Atari computer home, much as he would a hair dryer, and used it for a period of time to write a review. And if it was during one of Atari's misleading advertising campaigns on TV, stressing only game playing, then all the worse.

But *Consumers* is not the only party at fault. The entire home computer industry is to blame for continuing to sell, support, and advertise computers as either toys or simple-to-use devices. There is no way the sales staff of a chain discount store can understand the machines they sell and provide assistance to a naive consumer.

It is time for the entire industry to grow up. That includes the computer press, the popular press, manufacturers, and retailers. Okay, I will get off the soap box and press on.

A Fix

In addition to inheriting the Outpost legacy from John Anderson, I have also inherited whatever program bugs and *faux pas* may have occurred in previous columns. One such as yet unexplained

Arthur Leyenberger, c/o Creative Computing, 39 E. Hanover Ave., Morris Plains, NJ 07950.

bug appeared in the September 1983 Outpost.

Listing 1 was a modification to a Basic program that will make it a RUN-only program. That is, it will be unlistable by the author or anyone else. Listing 2 was a method to undo the process. Very useful for those forgetful souls who don't believe in making a backup (listable) copy of their programs. Now we come to the bug. As presented, Listing 1 will make your code unlistable but the routine in Listing 2 will not work. Only when Listing 1 is changed as follows, will it be relistable with the undo routine.

```
10000 POKE (PEEK(138)+256*
PEEK(139)+2,0):SAVE
  "D:FILENAME":NEW
```

I have added parentheses around and including the first PEEK instruction. My thanks to Dick Kushner for mentioning this bug. If anyone can explain why the procedure works with the added parentheses and not in the original form, let me know and I will publish the information.

Video Monitor Output For Your 400

The Atari 400 is all but gone from your dealer's shelves. In the last few months quite a few have been purchased for less than $100. Many people bought them as second computers. Others bought them, installed a keyboard and a 48K memory card, and had the near equivalent of an Atari 800 computer. The 400 is essentially the same machine under the hood as the 800, save for the video monitor output that the 800 provides.

Xtravideo I.

Now there is a modification you can make to your Atari 400 computer which will give you a monitor output. The mod is called the *Xtravideo I* and requires no soldering or other special skills to install. The module replaces the CD4050 integrated circuit and provides a composite video signal via a cable terminated in an RCA phono connector.

Installation is straightforward, following the simple instructions provided. The monitor output does not affect the normal RF TV output. The *Xtravideo I* comes with a lifetime warranty and is available from Hardsell. The cost is $39.95, which is not very much considering the added function you get.

Leave The Driving To Us

In my review of the *Atariwriter* word processor in the October 1983 issue of *Creative Computing* I said, "this may be Atari's best product in a long time." I also said that the word processor was one of the best for the Atari computer, but lacked any easy method for passing control codes to a non-Atari printer. I concluded that it was up to Atari to produce the printer drivers that were needed to make the *Atariwriter* the word processor of choice for the Atari computers.

I am happy to report that Atari has done just that. Printer drivers are now available at a nominal cost to turn *Atariwriter* into the easiest to use Atari word processor with the best value. The following printers are now supported: Atari 1020 and 1027; C. Itoh Prowriter 8510; Epson MX-80, MX-80 with Graftrax, MX-100, MX-100 with Graftrax, MX-80FT III, MX-100FT III, and FX-80; Gemini 10; and NEC 8023.

These 12 printer driver files are binary load files, and come on the one APX printer driver disk. You use DOS to copy the driver file for your particular printer onto your *Atariwriter* text disks as AUTORUN.SYS. Then, when you boot up the *Atariwriter* cartridge with your disk inserted in the drive, the driver loads into memory and you are all set.

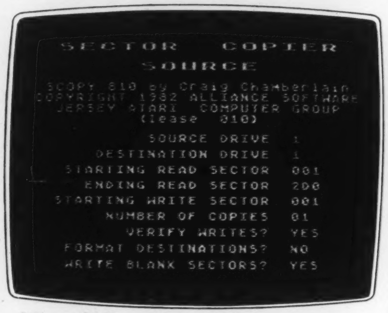
During your word processing session you may use all of the *Atariwriter* built-in commands directly, without having to worry about compatibility with your printer. On my Epson FX-80 printer, I can use proportional printing and print in double columns directly from *Atariwriter.* The results are excellent. The NEC and C. Itoh printers also allow proportional printing.

The *Atariwriter* printer drivers were written by Gary Furr, cost $17, and can be obtained from the Atari Program Exchange as product number APX-20223. *Atariwriter* and the drivers make this the finest word processor for the Atari computer.

A Couple Of DOS Improvements

The Atari Disk Operating System (DOS) is criticized for being slow in execution and not as feature-laden as possible. These facts are apparent when you try to do something as trivial as making a duplicate copy of a disk. Using the J option of the DOS menu (Duplicate Disk) requires three passes regardless of the amount of data contained on the disk. By the time the destination disk is formatted and the copy complete, over five minutes have elapsed—and your patience has worn thin.

Thanks to a program called *SCopy 810,* written by Craig Chamberlain, an entire disk may be duplicated in only two passes. Craig has written a sector copying program that will work in as little as 8K of RAM memory. The menu is continuously visible on the screen as are the data that are being copied (see photo).



```
  SECTOR   COPIER
      SOURCE
 SCOPY 810 by Craig Chamberlain
COPYRIGHT 1982 ALLIANCE SOFTWARE
 JERSEY ATARI  COMPUTER GROUP
          (lease  010)
           SOURCE DRIVE   1
      DESTINATION DRIVE   1
    STARTING READ SECTOR  001
      ENDING READ SECTOR  200
   STARTING WRITE SECTOR  001
       NUMBER OF COPIES  01
          VERIFY WRITES?  YES
   FORMAT DESTINATIONS?  NO
    WRITE BLANK SECTORS?  YES
```

SCopy 810.

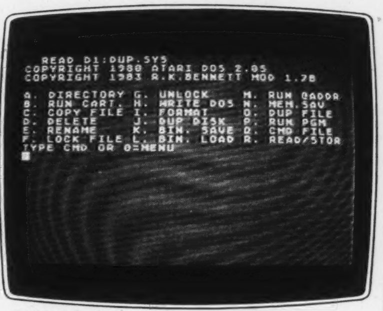
This program is not intended to copy protected software, and there is no provision for copying or creating bad sectors. However, as an easy method for backing up text or data disks, it can't be beat. An application that has saved me countless hours is to use the *SCopy 810* to format the text disk and duplicate the printer driver for the *Letter Perfect* word processing program. Rather than sequence through the arduous driver creation utility, I do it once, then use *SCopy* to duplicate as many text disks as I need. Since *SCopy* also formats a disk, even more time is saved.

Although the program was originally distributed by user groups under license from Alliance Software, it is now available directly from Alliance Software. The cost is $10 and includes a 17-page user guide and free postage. This is one of the most useful DOS utilities I have ever seen for the Atari computer.

Another useful DOS utility I use, and one that I would recommend to anyone who does a great deal of file manipulation, is *DOS-Mod* from Eclipse software. *DOS-Mod* is completely compatible with your existing Atari DOS 2.0S and contains several enhancements.

How would you like to be able to use full screen editing when using DOS, just as you do when using Atari Basic? You got it. How about being able to see more of what you are doing on the screen? No problem. *DOS-Mod* gives you more than half the screen, since its compressed menu takes up less room. Another aid to let you know what is going on is the minimum of screen clearing that occurs.

If this was all *DOS-Mod* allowed me to do I would say, "Okay, but so what?" There is more. Commands that used to take several lines and require answering prompts can now all be put on one line. The wildcard operators now work (as they should) with COPY, DELETE, and RENAME. And get this: *DOS-Mod* lets you create command files which may contain a sequence of commands that will be executed in one operation.



```
  READ D1:DUP.SYS
COPYRIGHT 1980 ATARI DOS 2.0S
COPYRIGHT 1983 R.K.BENNETT MOD 1.7B

A. DIRECTORY G. UNLOCK    M. RUN @ADDR
B. RUN CART. H. WRITE DOS N. MEM.SAV
C. COPY FILE I. FORMAT    O. DUP FILE
D. DELETE    J. DUP DISK  P. RUN PGM
E. RENAME    K. BIN. SAVE Q. CMD FILE
F. LOCK FILE L. BIN. LOAD R. READ/STOR
TYPE CMD OR 0=MENU
```

DOS-Mod.

Still not convinced? Then, throw in an excellent set of on-line tutorials that, when copied to a printer using C D1:*.*,P:, yield 48 pages of documentation. Finally, *DOS-Mod* fixes many of the bugs in Atari DOS—such as the RS-232 handler being destroyed on RESET and typical MEM.SAV problems.

DOS-Mod is an excellent product that greatly simplifies and expands the Atari DOS into a powerful operating system. It costs $35 and comes with a 30-day money back guarantee. The double density version costs $50.

Dear Santa . . .

It is the holiday season, and Atari folks look forward to checking the stocking on that special day for computer goodies. In keeping with this spirit, and perhaps leaving a few hints as to my own desires, I present my unscientific, seat-of-the-pants wish list of Atari-related goodies. The list is presented in no special order and reflects my own prejudices and biases—although I have used/played/tested all of the products and like them all for one reason or another. There is no way I can give any more than brief descriptions in the remaining space, but here goes.

A cute little stocking stuffer is the "The Secret of Perfect Memory" by Elephant Memory Systems. It only costs a buck and is packed with all sorts of disk-related information. It includes a glossary, disk and drive nomenclature, and pretty pictures, and may be found at stores selling Elephant Disks.

Another neat stocking stuffer is the Videomax Game Glove from Nancy and Company. For $6.95 plus $.50 postage you get a cure for the dreaded stick burn. Blisters are eliminated by this glove (mens, womens, and youth sizes, righty or lefty) made of calfskin with a velcro fastener in back. Quite comfortable to wear and sure to make you the talk of the arcade.

Are you a shoot-'em-up fan? Can't seem to get more than just a couple of megapoints each round of *Defender, Fort Apocalypse,* or *Zaxxon*? Then you need the Blaster from Questar Controls. For about $8 you dial up to 20 shots per second with just one joystick button press. Your joystick plugs into the Blaster which plugs into the joystick port.

I have small hands, and although I own and admire the Wico Command joystick, it just is too big for my paws. More and more I find myself using the Suncom Starfighter Joystick from Suncom. It costs about $12 and fits nicely into my palm. The stick is short and has a short throw which makes the action quite snappy.

"My report is a non-biochemical, non-psycho-sociological approach to the differences between the sexes."

Although I find it hard to use the Wico joysticks, I think they are probably the most rugged, professional sticks to be found anywhere. One Wico product I use constantly is the Arcade Trackball. Selling for about $40, this gadget is really sexy. Precision movement, a solid feel, and quality construction make you feel as if the arcade is in your living room. Try *Missile Command, Centipede,* or *Pole Position* with this beauty and you will never go back to a stick.

So far I have talked about stocking stuffers only. Let's talk a little about gifts. Topping the list, of course, would be a subscription to *Creative Computing*. You will be seeing more Atari coverage in future months. Next, how about Atari itself? For the best in word processing, consider *Atariwriter*. It would be especially useful for writing all of those thank you notes for Atari goodies you receive. If you want to have a youngster learn a computer language or become more comfortable with computers, Atari Logo is an excellent choice. I will be devoting an entire column to Logo in the near future. Both of these Atari products list for $99.95. Then, of course, there are those classic Atari games that you have been wanting.

If you have been waiting for a professional quality, easy to use plotting, graphics, and data analysis package for the Atari, you may want to consider the *B/Graph* package from Income Software. It lists for $99.95 and allows you to make bar, line, and pie charts, and perform regression analysis, exponential smoothing, and statistical analyses on either your screen or a printer. Most of the major printers are supported, and the program is very easy to use.

With all of these programs and disks you will be receiving, you will need some place to store them. Ring King Visibles has the most complete line of disk and cartridge holders I have seen. The disk holders range from a convenient three disk holder to a disk wallet, binder, and tray. They also make an inexpensive cartridge storage album.

I would be remiss if I did not mention at least a few games to include on your Christmas list. Any of the games from Electronic Arts would be a welcome addition to your game library. My favorites are *Archon* and *Pinball Construction Set.*

Another company that ranks high on my list of quality game producers is Odesta Software. They make the definitive board game translations of Chess, Checkers and Othello (*Odin*). Any one of these fine products is sure to please.

For you hackers, and occasional programmers too, a very useful product is the *Monkey Wrench II,* from Eastern

Outpost: Atari, continued...

House Software. This programmer's aid is a $59.95 cartridge that plugs into the right slot on the Atari 800. Its features include: automatic program line numbering, re-numbering; block copy, move, and deletions; and access to DOS functions directly from Basic. Additional features are too numerous to mention. A very handy tool for the Atari Basic programmer.

If you don't see any gift ideas here, then check out the last year's crop of Outposts. You will surely find something that is worthy of mention in your letter to Santa.

All of the products I have mentioned do exist, by the way. You can go into a store, shell out the cash, and walk away with the merchandise. I have a couple of items on my own wish list that *don't* exist at all. Perhaps an open letter to Santa or Atari or whomever will do the trick.

First on my list is an Atari computer that will run all of the existing software plus contain the new operating system that gives the extra graphic modes and help functions. I said *all,* which means that there would have to be two operating systems in the machine. A simple switch, both hardware and software controlled would configure the machine as I desire. And why not throw in a parallel and a serial port while you are at it. Memory of 64K is fine, but by all means, sell the computer at a competitive price.

My second wish is for an Atari-compatible (and other machine compatible) portable computer, along the lines of the Radio Shack Model 100. There is no reason the machine could not have 64K, disk drive, and video ports plus all of the goodies on the Model 100 and sell for *under* $500. If it existed, I would buy two of them right now.

My next wish is not for a product, but rather a policy. A *sane* software pricing policy. Over $40 for a cartridge game, over $30 for a disk game, and $100 for application software is too expensive. It limits the accessiblity of computing to an affluent few, fosters software piracy, and breeds contempt for software manufacturers. Fortunately, Atari software is not as high-priced as other software.

"According to this your total is $47.32, your last name is Robertson, and you won't have a nice day until 1985."

Finally, my last wish is that you have a very happy holiday. Be of good cheer, and remember that there is more to life than the latest video game or Basic utility. Take time to enjoy your family and friends because they are most important of all.

See you next time. END

Firms Mentioned In This Column

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Birmingham, MI 48009.

Eastern House Software
3239 Linda Dr.
Winston-Salem, NC 27106.

Eclipse Software
1058-J Marigold Ct.
Sunnyvale, CA 94086.

Electronic Arts
2755 Campus Dr.
San Mateo, CA 94403.

Hardsell
P.O. Box 565
Metuchen, NJ 08840.

Inhome Software
2485 Dunwin Dr.
Unit 8
Mississauga, Ontario
Canada LS1 1T1.

Nancy and Co.
22594 Mission Blvd.
Suite 302
Hayward, CA 94541.

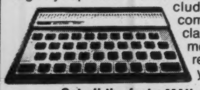
Odesta Software
930 Pitnes
Evanston, IL 60202.

Questar Controls
670 N.W. Pennsylvania Ave.
Chehahlis, WA 98532.

Ring King Visibles
215 W. Second St.
Muscatine, IA 52761.

Suncom
650 Anthony Trail
Suite E
Northbrook, IL 60062.

Wico
Consumer Division
6400 W. Gross Point Rd.
Niles, IL 60648.



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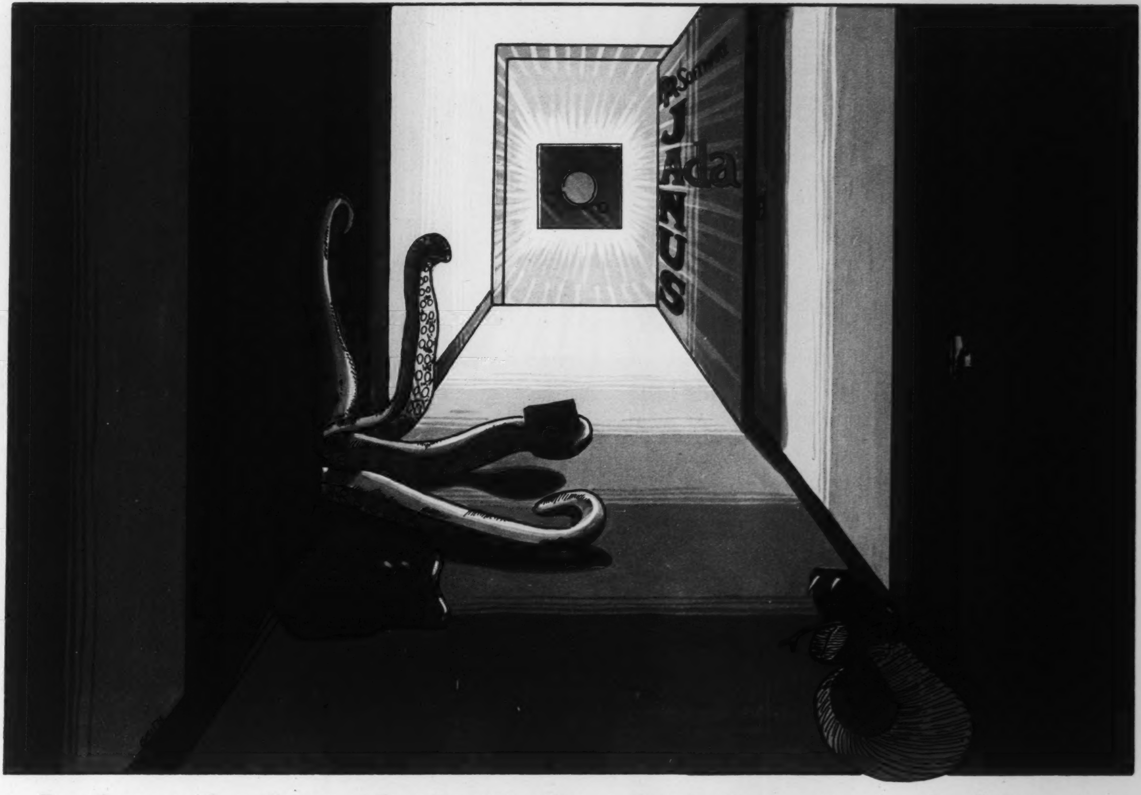

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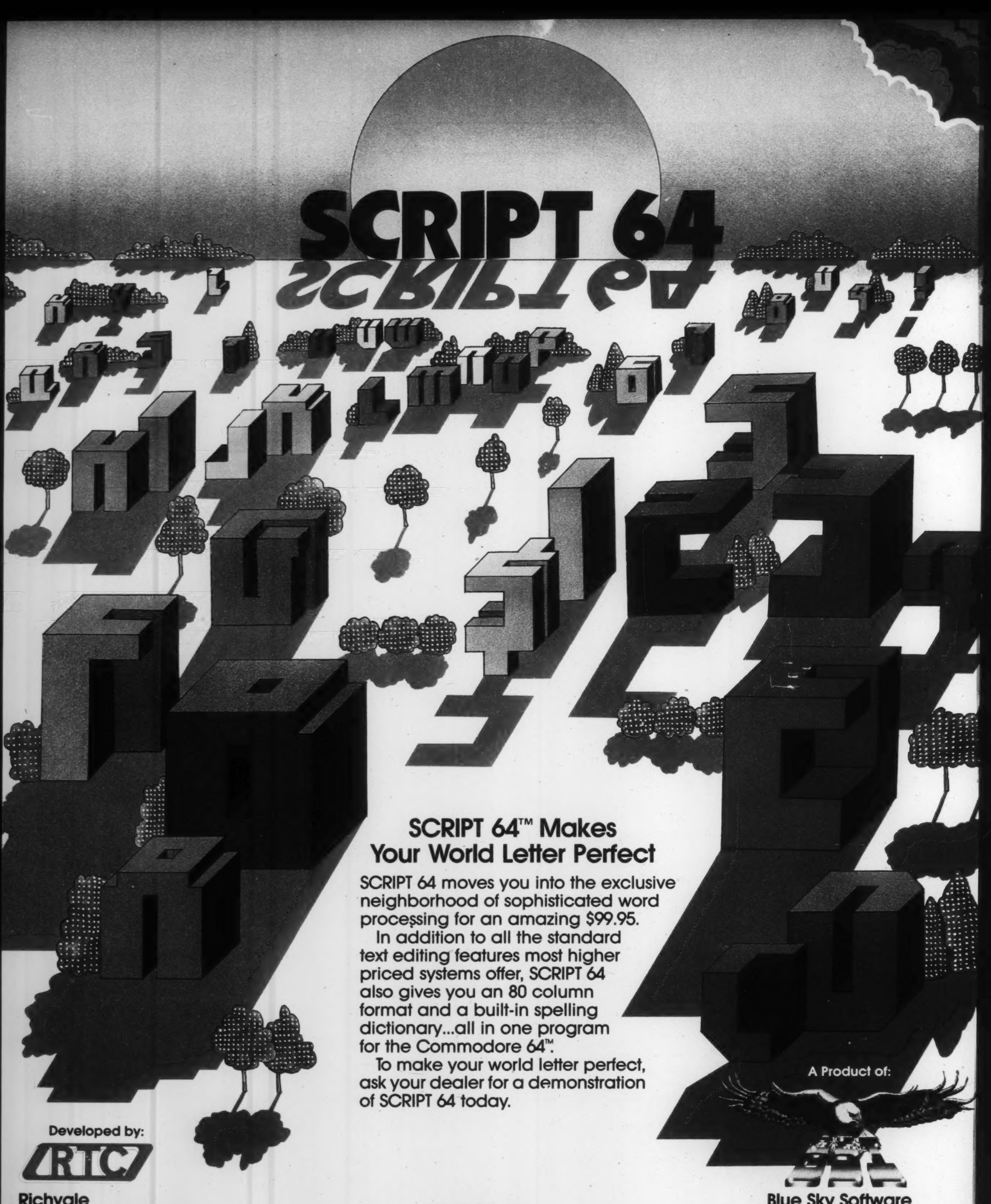

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Commodore's Port

John J. Anderson

Ahoy, Commodorians, and welcome aboard. This month we will make up a holiday wish list for Commodore computer users. But first, let's make a couple of quick diversions.

If you caught the November 1983 issue of *Creative Computing,* you'll know that the big news this season is the advent of *Simons' Basic,* the super Basic from Commodore for the C-64. It includes 114 new commands for programming and program editing, graphics, and sound. Finally, the casual user may have a chance to get the most out of his Commodore 64. At $30, *Simons' Basic* is a must for *every* C-64 owner. See Tim Onosko's review in the November issue.

We will be providing full, *tutorial* coverage of the product in upcoming Commodore's Ports. Keep an eye out.

Next, a quick swing to the mailbag. From Jeffrey Groby, in Florissant, MO, come the following comments:

"As a new owner of a Commodore 64, I was astonished by sprites, but found them very tedious to define. When I purchased the September 1983 issue of *Creative Computing,* I saw the sprite editor, and was overjoyed. I typed in the program and ran it, and after a while found a minor mistake. If readers make the following change, the program will run as it should:

```
130 IF A$ CHR(17) THEN L=
    L-1:GOTO 600
150 IF A$ CHR(145) THEN
    L=L+1:GOTO 600
```

"I commend Mr. Lane on the value of this program."

And from Tyler Jensen, of Roosevelt, UT, the following:

"With great anticipation, I await the arrival of each issue of *Creative Computing.* I read and reread every article, absorbing the information on every page.

"Before spending a dime on my new Commodore 64 (my first computer), I renewed my subscription to your magazine. I especially enjoy reading about new developments in the micro industry, and your hardware and software evaluations.

"With every issue, I see at least one and usually more letters to the editor with complaints of some sort. There is hardly ever a complimentary letter. The staff at *Creative Computing* deserves better than that.

"So, a 17-year-old senior at Union High School gives his thanks for a job well done. Keep up the good work."

Thanks very much, Tyler. We here in the depths of New Jersey appreciate your kind words. We will always give space in the magazine to those with a beef or criticism—that is a part of our professional responsibility. We receive plenty of complimentary letters, too, but we usually resist the temptation to publish them.

Fa La La La La

On to our holiday wish list. 'Tis the season to be jolly, you know, and nothing makes us more jolly than new hardware and software to complement our Commodore systems.

As a traditional holiday service, *Creative Computing* will help you take the guesswork out of microcomputer gift giving. Using a highlighter, mark the following passages that most pertain to your own desires. Then leave the magazine, open to Commodore's Port, in a conspicuous place. The bathroom is frequently a shrewd choice, but use your own discretion.

Hardware

- *Disk drive.* Certainly this is among the most desired peripherals for any computer system. If you have been plodding along with a Datasette recorder, you haven't really learned what the Vic 20 or C-64 can do when hooked up to a random access mass storage device. It is probably fair to say that a computer without a true random access storage device is not a computer at all. The Commodore 1541 is not the fastest disk drive around, nor is it the easiest to use. It is, however, one of the best buys available, at about $250.

That is, of course, if you can find one. The fact of the matter is that 1541 drives are in tremendous demand right now, and production problems at Commodore have kept supply lagging seriously behind demand since September. So maybe you should not get your hopes up too high—even if Santa is kind enough to try to get you a gift drive this holiday season; it may not come to pass. I am assured that the elves are working as hard as they can, though.

- *Printer and/or printer interface.* Commodore has two low-priced 80-column printers now. The 1525 is priced at around $250, and its successor the 1526 has been scouted at about $325. The obvious printer application is word processing on your Commodore.

There are many quality word processing software packages available for your Vic 20 or Commodore 64, and we will mention a few further ahead. For students, the move to a word processor can

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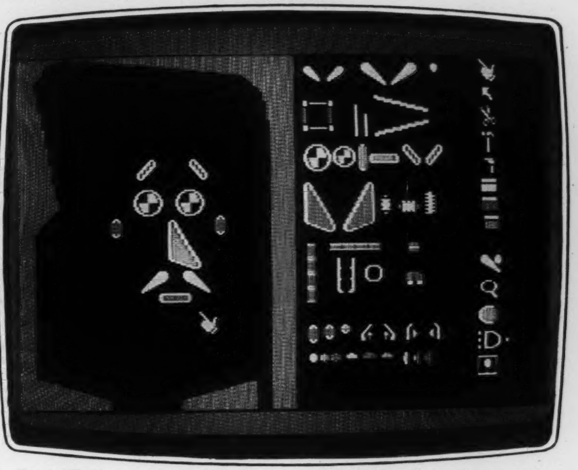
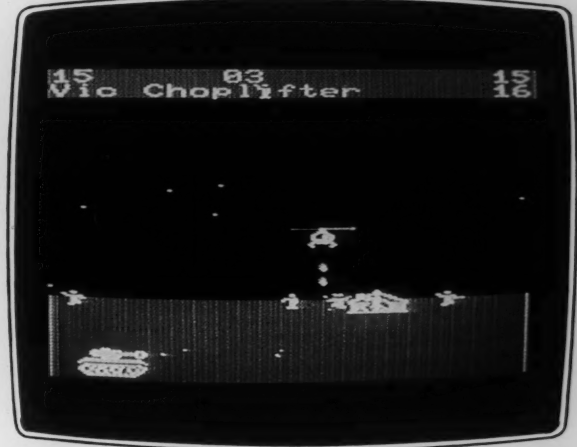


Pinball Construction Set: soon to be a classic for the C-64.



Choplifter: even the Vic 20 version captures the full flavor of the game.

make a very real improvement in the quality of compositions and term papers.

A printer can also be an invaluable aid in learning programming. Hard copy of long listings makes debugging much easier—and program flow simpler to follow.

Another way to add a printer to your system is to buy a special interface to allow your Commodore to hook up to standard configuration printers from third-party sources. Then you can drive any Centronics parallel printer, including letter-quality daisywheel machines. (Bear in mind that daisywheel printers will not be able to depict special graphics characters.)

Some interfaces provide emulation of Commodore printers on third-party machines that have dot-addressable graphics capability. Other interfaces print special English codes on non-graphics printers to indicate the function or needed keypresses represented by special graphics characters.

- Microware offers "Connection" interfaces priced from $30 to $120. Their units work with the Vic 20 and the C-64, and provide full emulation of Commodore printers.
- For the Commodore 64, Richvale Telecommunications has introduced an extremely flexible interface called C-64 Link. Any device complying to a standard known as IEEE can then be connected to a C-64 computer. This includes serial and parallel printers, the older but very reliable Commodore 4040 disk drives, and other C-64s. It lists for $185.
- The CPI interface from Micro Systems Development works with either the Vic or the C-64. It provides English tags for special graphics characters. It plugs directly into the serial port of the Commodore and requires no special software. $80.
- The Interpod from Limbic Systems adds the ability to access not only serial and parallel printers from your 64 or Vic, but hard disk units and plotters as well. It is similar in concept to the C-64 Link, providing IEEE standard, from whence a wide range of possibilities become available. The unit lists for $180.
- Card/Print is from Cardco designed to work with the Commodore 64 or Vic 20, and with just about every parallel printer on the market, without special software. At $19.95, it is one of the least expensive printer interfaces on the market today.
- *Monitor.* The Commodore 1701 monitor is now an excellent buy at under $250. Hooked up correctly, it marks a massive improvement in video quality—as well as freeing up the regular TV so your hobby does not infringe on normal viewing. Other monitors, such as the Amdek Model 1, can also do a good job, but the 1701 is a tough deal to beat.
- *KoalaPad.* Now available for the Commodore 64, the KoalaPad, with its companion software *Micro Illustrator,* provides capabilities that required a multi-thousand dollar system just a couple of years ago. A full review of the Apple version appears elsewhere in this issue. Under $125.

Software

Apple owners have some great software available to them—it makes Atari-types jealous sometimes. Atari owners, on the other hand, claim some of the best games around, for any system, take it from me. Sometimes it makes Apple owners misty-eyed.

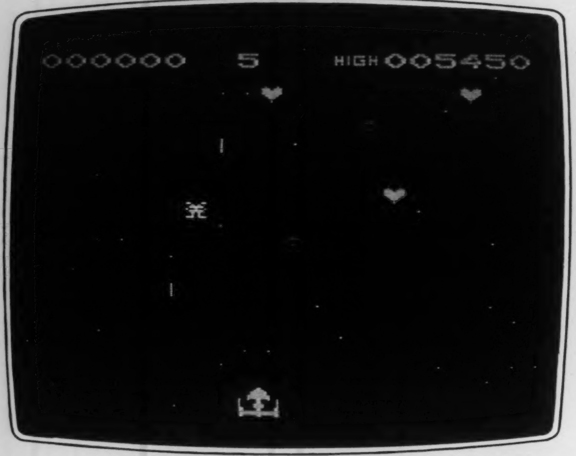
And what about Commodore 64 owners? Well they may truly rejoice, for they shall have the best of both worlds. Apple and Atari software is being busily translated to run on the 64, and the library grows daily. The 64 handles Apple bit-mapped as well as Atari player-missile (sprite) graphics with great dexterity, and translation from these other 6502 machines, while not a trivial task, does not require total rewriting.

Not to slight original efforts for the 64, but frankly, the best software packages available for the Commodore 64 right now are translations from the Apple and Atari. From Broderbund, for example, there are superb versions of *David's Midnight Magic, A.E.,* and *Choplifter.* The top-notch houses, including Sierra On-Line, Sirius, and Synapse, are working night and day to translate their hits for the 64.

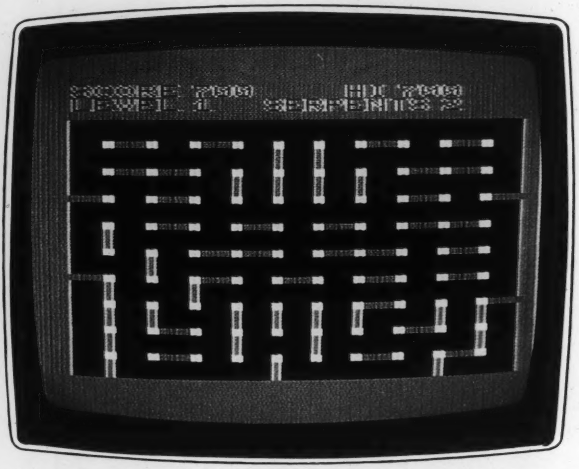
Electronic Arts has announced the release of *Hard Hat Mack, Axis Assassin, Pinball Construction Set, MULE, Worms?, Archon,* and *Murder on the Zinderneuf* for the Commodore 64. I cannot think of better news for game-loving Commodore owners.

And what about you, Vic 20 types? Are you to be left in the cold this Christmas? No sirree. Try the Vic version of *A.E.* on for size. When I first saw it at the summer CES, I absolutely could not believe it was actually running on a Vic. It is magnificent! In addition, all of the houses mentioned above are also working on Vic translations of their major titles.

Then there is Tronix, with games such as *Swarm, Sidewinder, Scorpion, Deadly Skies, Gold Fever, Kid Grid,* and *Juice.* Jimmy Huey's games manage to wring every last bit of capability from the Vic



Swarm: Tronix games make the Vic 20 seem like a different machine.



Serpentine: A faithful translation to the Vic 20 from Broderbund.

20—and make it look like a 64 in the process. And now Tronix is setting its sights on the Commodore 64!

If you are looking for a word processor for your Commodore 64, there are many new packages to choose from. What follows is by no means complete, but a partial list of new packages:

- *WordPro Plus* from Professional Software. Available for the C-64 computer in packages selling for as low as $90. It has all the features found on much more expensive systems, and it supports math functions.
- *Bank Street Writer* from Broderbund. Soon to be available for the Commodore 64. A great entry level word processor, easy enough for kids to learn to love. A full review of this product appeared in the April 1983 issue of this magazine. $70.
- *Paper Clip.* A $125 word processor from Batteries Included for the Commodore 64. All standard functions, and designed to work with popular 80-column cards.
- *Busiwriter.* C-64 word processing with a 20 page memory. $99 from Skyles Electric Works.
- *HomeWord.* Ken Williams, of Sierra On-Line, dropped by the other day—and I managed to miss him, gosh darn it. But he did leave a copy of Sierra's new Word processor *HomeWord* with Editor Arrants. This is a $50 package that uses icon-based windows a la Lisa, and which just might give *Bank Street Writer* some serious competition. *HomeWord* will soon be available for the Commodore 64.

Word processing on the Vic is not as easy, because of its 22-character display and limited memory capacity, but it is possible. *Wordcraft* for the Vic received a favorable review in the November issue. Other packages, from Commodore itself and companies such as Quick Brown Fox, offer serviceable, low-level word processing for the Vic 20. Check your dealer!

And from all of us, the best for the holiday season and in the year to come.

Firms Mentioned In This Column
Microware Distributing
1342B Route 23
Butler, NJ 07405
(201) 838-9027.

Richvale Telecommunications
10610 Bayview Plaza
Richmond Hill, Ontario,
Canada L4C 3N8
(416) 884-4165.

Micro Systems Development Inc.
11105 Shady Trail, Suite 104
Dallas, TX 75229
(214) 241-3743.

Limbic Systems Inc.
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Palo Alto, CA 94303.
(415) 964-8788.

Cardco Inc.
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Witchita, KS 67214
(316) 267-6525.

Koala Technologies
4962 El Camino Real Suite 125
Los Altos, CA 94022
(415) 964-2992.

Professional Software Inc.
51 Fremont St.
Needham, MA 02194
(617) 444-5524.

Broderbund Software
1938 Fourth St.
San Rafael, CA 94901
(415) 456-6424.

Batteries Included
186 Queen Street West
Toronto, Ontario Canada M5V 1Z1
(416) 596-1405.

Skyles Electric Works
231G South Whisman Rd.
Mountain View, CA 94041
(415) 965-1735.

Sierra On-Line
Sierra On-Line Building
Coarsegold, CA 93614
(209) 683-6858.

Tronix
8295 South LaCienega Blvd.
Inglewood, CA 90307
(213) 215-0529

Electronic Arts
2755 Campus Dr.
San Mateo, CA 94403
(415) 571-7171 END

NEW!

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by NEIL KONZEN

$49.95: Includes Peeks/Pokes Chart & Tip Book #7.

NOW A BEAGLE BROS DISK! GPLE lets you edit Applesoft program lines *FAST* without awkward cursor-tracing and "escape editing".

INSERT & DELETE: GPLE works like a word processor for Applesoft program lines. You make changes instantly by jumping the cursor to the change point and inserting or deleting text. No need to trace to the end of a line before hitting Return.

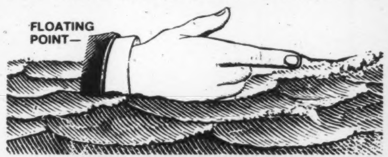
GLOBAL SEARCH & REPLACE: Find any word or variable in your programs, *FAST*. For example, find all lines containing a GOSUB, or edit or delete all lines with REM statements, or all occurences of any variable. **Replace any variable**, word or character with any other. For example, change all X's to ABC's, or all "Horse" strings to "Cow".

80-COLUMN COMPATIBILITY: All edit & global features support **APPLE IIe** 80-column cards and most 80-column cards on *any* Apple IIe, II+ or II.

DEFINABLE ESC FUNCTIONS: Define ESC plus any key to perform any task. For example, **ESC-1** can catalog drive 1, **ESC-L** can do a "HOME: LIST", **ESC-N** could type an entire subroutine... *Anything* you want, *whenever* you want.

GPLE DOS MOVER: Move DOS and GPLE to Language Card (or IIe upper 16K) for an EXTRA **10,000 BYTES** (10K) of programmable memory.

Plus APPLE TIP BOOK #7: Learn more about your Apple! Includes all new GPLE tips and tricks.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$29.50: Includes Peeks/Pokes Chart & Tip Book #3

LIST FORMATTER prints each program statement on a new line. Loops indented with printer Page Breaks. A great Applesoft program de-bugger.

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$39.50: Includes Peeks/Pokes Chart & Tip Book #4.

DRAW IN HI-RES on both Apple "pages" using easy keyboard commands OR paddles/joystick. Pre-view lines before plotting. Solid or mixed colors & Reverse (background-opposite) drawing. FAST one-keystroke circles, boxes & ellipses, filled or outlined. Add text for graphs & charts. All pix Save-able to disk, to be called from your Applesoft programs.

COMPRESS HI-RES DATA to 1/3 disk space (average) allowing more hi-res pictures per disk.

MANIPULATE IMAGES: Superimpose any two images, or RE-LOCATE any rectangular section of any drawing anywhere on either hi-res page.

HI-RES TYPE: Add text to your pictures with adjustable character-size and large-character color. Type *anywhere* with no Htab/Vtab limits. Type sideways too, for graphs. Includes Tip Book #4.

#7

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* DISKQUIK requires Apple IIe.
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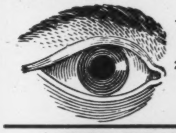
$34.95: Includes Peeks/Pokes Chart & Tip Book #6. Requires Apple IIe (OR II/II+ with RAM Card).

RENAME ANY APPLESOFT COMMAND or Error Message to anything you want. For program clarification, encryption/protection or even foreign translation. Plus add optional powerful NEW COMMANDS:

ELSE follows If-Then statements, like this:
IF X=2 THEN PRINT "YES": *ELSE* PRINT "NO"

HSCRN reads color of any hi-res dot for collision testing. **SWAP X,Y** exchanges 2 variables' values. New **TONE** command writes music with no messy pokes & calls. **SCRL** scrolls text in *either* direction. **TXT2** lets Text Page 2 act exactly like Page 1.

PLUS: GOTO & GOSUB may precede variables, as in "GOSUB FIX" or "GOTO 4+X". Escape-mode indicated by special ESC CURSOR. Replace awkward Graphics screen-switch pokes with 1-word commands. Change ctrl-G Beep to any tone. **INVERSE REMS** too! All GPLE compatible.



```
1 FOR S=768 TO 773: READ A:
  POKE S,A: NEXT: POKE 232,0:
  POKE 233,3: DATA 1,0,4,0,5,0
2 HGR2: FOR R=0 TO 192: ROT=R:
  SCALE=96: XDRAW 1 AT 140,95:
  SCALE=30: XDRAW 1 AT 140,95:
  S=PEEK(49200): NEXT: RUN
```

PRONTO-DOS

HIGH-SPEED DOS / DOS-MOVE UTILITY

by TOM WEISHAAR

$29.50: Includes Peeks & Pokes Chart

TRIPLES THE SPEED of disk access and frees 10,000 bytes of extra memory by moving DOS.

Function	Normal	Pronto
BLOAD HI-RES IMAGE	10 sec.	3 sec.
LOAD 60-SECTOR PROGRAM	16 sec.	4 sec.
SAVE 60-SECTOR PROGRAM	24 sec.	9 sec.
BLOAD LANGUAGE CARD	13 sec.	4 sec.

(Text Files: No Change)

Boot the Pronto disk or your updated disks, created with the normal INIT command. Compatible with all DOS Commands, GPLE, Double-Take, DOS Boss, Diskquik and almost all unprotected programs.

MOVE DOS to your Language Card, RAM Card, or standard Apple IIe upper 16K, freeing up **10,000 EXTRA BYTES** of memory for your programs.

15 EXTRA SECTORS per disk. Catalog Free-Space displayed every time you catalog a disk.

TYPE-COMMAND ("TYPE filename") prints contents of any Text File on screen or printer.

NEW!

DISKQUIK

DISK DRIVE EMULATOR

by HARRY BRUCE and GENE HITE

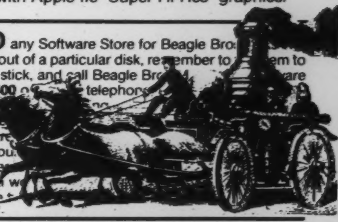
$29.50: Includes Peeks & Pokes Chart
Requires Apple IIe with Extended 80-column Card.

ACTS LIKE A DISK DRIVE in Slot 3, but much faster, quieter, more reliable and $350 cheaper. Enjoy the benefits of a 2nd (or 3rd or 4th...) drive at less than 1/10th the price. Catalogs normally with "CATALOG, S3" command. Load & Save any kind of files into RAM with normal DOS commands.

SILENT AND FAST: Since no moving parts are involved, Diskquik operates silently and at super-high speeds. See it to believe it. Your Apple IIe's Extended 80-column Card (required) can hold about half the amount of data as a 5¼" floppy disk!

MANY USES: For example, load often-used files, like FID and other utilities, into RAM when you boot up, so they are always available when you need them. Copy files from RAM onto disk and vice versa, just as if a disk drive were connected to slot #3.

FRIENDLY & COMPATIBLE with 80-column display, GPLE, ProntoDOS, and all normal Applesoft and DOS commands and procedures. Will not interfere with Apple IIe "Super Hi-Res" graphics.



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our dis [illegible]
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are unprote [illegible]
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2-WAY-SCROLL/MULTIPLE UTILITY

by MARK SIMONSEN

$34.95: Includes Peeks/Pokes AND Tips/Tricks Charts.

2-WAY SCROLLING: Listings & Catalogs scroll Up AND Down, making file names and program lines much easier to access. Change the Catalog or List scroll-direction at will, with Apple's Arrow keys.

BETTER LIST FORMAT: Each program statement lists on a new line for *FAST* program tracing & de-bugging. Printer-compatible; any column-width.

VARIABLE-DISPLAY: Displays all of a program's strings and variables with current values.

CROSS-REFERENCE: Sorts and displays line numbers where each variable & string appears.

BETTER RENUMBER/APPEND: Merges programs (doesn't just connect end-to-end).

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☐ DiskQuik	29.50	☐ Utility City	29.50
☐ DOS Boss	24.00	☐	
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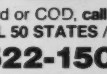

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Notebook/Portable Computing

John J. Anderson

In the August 1983 issue of this magazine, I reviewed the TRS-80 Model 100. In that review, I predicted that the introduction of truly portable machines like the Model 100 and the NEC PC-8201 would spell doom for the "sewing machine" portables.

Osborne To The Ozone

I hadn't imagined how soon. Osborne, the king of the sewing machine genre, has gone belly up. Touted a year ago as among the hottest companies in the industry, Osborne stands as a testimony to the volatility of the micro industry.

To pin the downfall of Osborne specifically and exclusively on the ascendancy of machines like the Model 100 would be inaccurate. Osborne was having problems before the Model 100 came on the scene. One of the early distress signals sounded when Osborne quietly announced IBM compatibility in new models. Perhaps IBM compatible sewing-machine portables from Kaypro and Compaq had as much to do with the end of Osborne as any LCD portable.

It is worth a bit of space here to salute Adam Osborne, even in bankruptcy. He was a forward-looking voice in the industry long before it became fashionable to be a forward-looking voice in the industry. He spoke portentously about the future of microcomputers at a time when others scoffed. Then they listened, and listened hard.

As a publisher, he introduced many to the field of computing. As a writer, he managed to entertain and teach at the same time. As an industry analyst, he offered insight. When he introduced the "Volkswagen of microcomputers," with hundreds of dollars of free bundled software, he broke new ground.

But in micros six months is a generation. Things change fast. Maybe too fast.

Lest this begin to sound too much like a eulogy, I should stress that Adam is very much alive. He may no longer be an *enfant* infallible, so to speak. He now has a failure under his belt. But he is still a young man, and it will be interesting to see what he does next. We wish him the very best. Now if only he had given the computer his *first* name . . .

Model 100 Mailbag

I would like to share with you some of the responses I have received concerning the Model 100 review. I have gotten more mail on that piece than on any other single topic I have ever covered. In fact, it is still pouring in.

> ***I was probably too hard on Tandy in underscoring the Japanese conection.***

One prominent letter was from no less than Jon Shirley himself, former vice president of marketing for Tandy, new CEO at Microsoft. He was angry at my portrayal of NEC as having had a part in the development of the Kyocera prototype that later became the Model 100.

"NEC had no involvement in the Model 100 at any time during its development, nor does it have any now," Shirley stated. "In addition, the substantial differences between the Model 100 and the NEC 8201 are due to our direct dealing with both the manufacturer and with Microsoft in working out the specifications for the Model 100. In fact, the built-in modem design was done by Radio Shack."

In hindsight, I *was* probably too hard on Tandy in underscoring the Japanese connection. I was reacting to the nearly universal portrayal elsewhere of the product being *born* in Fort Worth, which it was not. In the Model 100 write-up for the 1983 *Buyer's Guide*, I changed the copy to reflect Shirley's justified objections. People like Bill Walters at Tandy did work closely with Kyocera in the development of the 100, and NEC stayed out of that part of things.

But that wasn't all that got Shirley's goat. "As far as the price is concerned, I think the comment on 'profit-taking' is ill-advised. Any manufacturer can go get quotes on CMOS devices, especially RAM, and on 40 by 16 LCD displays, and confirm that the price is not unreasonable. Of course the price will go down over time, but not until more than two suppliers can make CMOS static RAM in quantity."

While the point is taken, I'll stick by my guns on that comment. The NEC 8201, which is a very similar machine to the 100, should be on retailer's shelves by the time you read this—at a list price of $799 for the 16K model.

Next, from Harry Broussard of Albuquerque, NM, comes the following:

"Plaudits to John Anderson and David Ahl for their fine coverage on the Model 100 and its NEC counterpart in the August issue. As another devotee of supine word processing, I am composing this letter in bed.

"The comparison of the Radio Shack and NEC versions of the machine was excellent, and provided unique insight into the trade-offs Tandy faced in tailoring the unit to the U.S. market.

"Thanks also for the game—it is a good example of how much entertainment can be squeezed into 2K of Basic.

"Be aware that the modem and cassette DIN cables *can* be accidentally reversed. I would have preferred a modular phone jack for the modem, instead of a DIN, even at the expense of the automatic dialer and dial-through phone functions."

Thanks for the comments, Harry. It is true that you can plug the cassette cable into the phone DIN. But you can't plug the phone cable anywhere but where it belongs. And as far as I am concerned, the built-in modem and dialer is exactly the place where the Model 100 has the NEC 8201 beat by a mile.

From Katherine Cochrane, in Honolulu, come these comments:

"I thoroughly enjoyed your review of the Model 100, but there are a few minor misstatements I would like to correct.

"Most important to someone like me, who uses her computer mainly for word processing, is to correct the notion that the left margin and page breaks cannot be set from TEXT. If the printer being used accepts print codes as my NEC 3530 Spinwriter and others do, these features indeed can be set.

"Another error in the article was the statement that the FIND command in TEXT works only once. If you press the FIND key (F1) again and ENTER without changing the key word, it will continue searching the document from that point, until it comes up with the next occurrence. This can be repeated until reaching a 'no match' response.

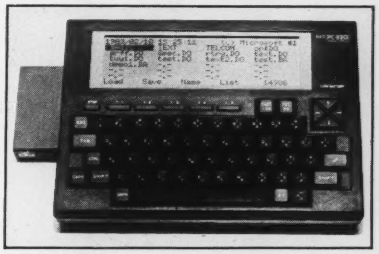
"A final misconception was found in the sidebar by David Ahl. This was the idea that those huge cassette machines are necessary for tape storage with the Model 100. I have been using a GE 3-5316A minicassette recorder with NiCad batteries, and have had no problems at all. Despite what Radio Shack's manuals and salespeople have told me, an AUX socket is not necessary: the MIC socket works just fine.

"Since I knew two months ago that I would be getting a Model 100, I have been reading every article I have seen on it, and that's a lot! Your report was by far the most complete and, with the few exceptions noted, the most useful."

Thank you, Katherine. I know you know that dumb printers are not able to have left margin and page breaks set from TEXT, and that those were the printers I was talking about. Basic text formatter programs now abound to get by the acknowledged weaknesses of TEXT when it comes to producing hard copy.

You are quite right about the FIND command, although I would have been happier with a more sophisticated search function—such as one with the ability to replace. Still, I was wrong when I reported that the FIND function terminated upon first match. All you need to do is invoke it again from the last point, with two keystrokes, through to the end-of-file.

As for interfacing to cassette, I have tried recorders without AUX sockets and had *no* success trying to save data. The same goes for Walkman-style recorders without REMOTE sockets. Overall I have found even audio cassette recorders that *do* work to be pretty finicky. So while I applaud your success with a tiny machine, I think it would be mistaken to thereupon conclude that a wide range of dictation recorders will work well with the Model 100.



The NEC 8201 is in many respects identical to the Model 100.

Finally, from Dr. Stephan Ritzmann, of Baylor University in Dallas:

"Your article on The First Purely Practical Portable summarizes succinctly the numerous disadvantages and few advantages of modern systems.

"From painful personal experience, I can wholeheartedly support your statements regarding the HX-20 and its unfulfilled promises. I disagree, however, with the notion that 'it makes more sense to keep the printer outboard.' Writers, editors, scientists, etc., who need to proofread their typed material in real time prior to relaying it for final processing would find such an amputated system utterly unsatisfactory."

I disagree, Dr. Ritzmann. I, for one, would find proofreading my manuscripts on a cash register tape unsatisfactory, which is what inboard printers currently offer. How worthless! I would much rather have an 80-column portable printer alongside the Model 100 in my briefcase. When (and only when) it was needed, it could be then hooked up for reasonable hardcopy. Professionals like yourself need fullsize 8½ × 11 inch printouts. Leave lesser stuff to K-Mart and the local delicatessen. Small, lightweight 80-column models of the kind I have described are the future of the low-end printer industry. Keep an eye on our column "Print about Printers."

Thanks to all who wrote to respond with their feelings about the Model 100. Rest assured that our commitment to the Model 100 will be ongoing—in this column and elsewhere in *Creative Computing.*

More From Portable Support Group

In the October issue of *Creative,* Glenn Hart reported on *Businesspak+*, a package of six programs designed for the Model 100 with the businessman in mind. Glenn was quite favorably impressed with the quality and utility of these programs, which include a vastly improved word processor that works alongside TEXT, a spreadsheet program, a business graphics generator, a Telex communications program, and a data management system.

There are now two more packages from Portable Computer Support Group, the people who brought you *Businesspak+*. They are *Sort2+* and *Data+*, and are designed to improve the performance of data management as effected through *Businesspak+*.

Sort2+ is used with *Put+* or *Data+* to sort listings from any category, alphabetically or numerically. Because it manipulates the target file during the sort, it requires only 1K of free memory while sorting. *Sort2+* can handle 100 records in less than a minute.

Data+ allows you to arrange information rapidly in an orderly fashion in any TEXT file you choose. In this way file listings can be sorted, searched (using FIND), and produced as logically arranged hard copy. Records can be edited or revised with minimal effort. Selected records can be added, and merge capability works with any other text file.

Using *Data+*, you can finally keep Model 100 data files continually sorted and merge list information with other text files as necessary. And, it works fast! As mentioned, *Sort2* can work directly on *Data+* files.

Owners of *Businesspak+* will without exception want to get these new packages as soon as possible. *Sort2+* lists for $30, *Data+* for $60. Contact Portable Computer Support Group, 11035 Harry Hines Blvd. 207, Dallas, TX 75229. (214) 351-0564.

Until next time, lap it up!

Computing For The Handicapped

Shel Talmy

Truism—The dual worlds of computers and electronics have made and are making life easier for millions of people. The corollary to that is, people take technology for granted today that would have seemed like science fiction a mere ten years ago.

There is another group of millions who have been receiving the residual benefits of existing technology. These are the handicapped. Until recently, they had to make do with products designed for the general public, that were converted for their use. This is no longer the case.

Today, many dedicated and farsighted people are creating products specifically for the handicapped, and the curious thing about this is that much of what is being created is exportable for use by the general public—a healthy tradeoff.

The purpose of this column is to keep you informed of what is happening in this overlooked field. I will be reviewing and evaluating computers and related products, software and electronics. If you have a friend who is handicapped, tell him or her about what you read here. It might provide that extra measure of independence that all handicapped people crave.

To illustrate what I mean about products that are useful for all, I want to tell you about a demonstration I was given at the Braille Institute in Los Angeles. It was for a computer and software system to be utilized by the visually handicapped, and to understand it, perhaps I should tell you something about the people who created it first.

The Mix

Anyone who has sampled a Piña Colada knows that the combination of pineapple juice, coconut, and rum produces a mellow concoction that slips down so easily that you remain unaware of its effects until you fall off the bar stool. The blend is rare, and when it works—watch out.

And so we have AVOS, which stands for Audio Visual Operating Systems. Take one John Hlivjak (pronounced liv-e-ak), a blind electronics retailer; one talented technician named Don Krantz; and one Roger Sax, retired lawyer and real estate broker. Shake well and voila! You have a young, aggressive company with an innovative approach that will go a long way toward filling a vacuum.

Hlivjak snatched Krantz out of the air, literally. Both are licensed Ham operators, and became acquainted during radio contact. On one such occasion, Hlivjak dropped a casual remark that he wished he could get a VU meter with an audio output to use in his work, and bemoaned the fact that the only one on the market cost $400, and if that weren't bad enough, had a limited range of functions. Krantz investigated, told Hlivjak he could build him what he wanted—and did.

Hlivjak was presented with a VU meter that did everything he wanted and more, at a third the price of the existing item. It was the beginning of a relationship.

Enter Roger Sax, who was finding that retirement left him with too much time on his hands and no channel for his energy. The result of the meld is the AVOS System.

The System

The system consists of a standard Osborne 1 that contains 64K of RAM (random access memory), and two 5 1/4" double density drives with 185K of storage per drive, plus the Street Electronics Echo GP voice synthesizer.

So far, so what—equipment you can pick up at any computer store. What makes this system special is the software. Perhaps the best way to describe it is "thoughtful."

According to Hlivjak they chose the Osborne 1 because it best suited their initial objectives. It was portable, within the financial reach of most people, and easily adaptable for the special software.

The software was written under Krantz's direction, and three teams of programmers participated. The package supplied with the system consists of a voice driver system that is self-loading, a voice-oriented text editor/word processor, an intelligent text formatter for printer output, a filing/database program, a personal finance package, and a couple of games. Also included in the package are eight tutorial and reference cassettes that teach you how to use the computer and the programs, and a beginner's course on programming.

All programs give simple vocal prompts for the visually impaired user. Menus are read on request using a question mark. I mention this because I would like you to imagine a directory that *you* could scan in a few seconds being read line-by-line, slowly by a synthesizer with a strange accent. It is a real time saver.

One of the nicest features of the software is the "reader mode." With it, the keypad becomes a command center. In word processing, for example, one number advances the cursor a letter; another, a word; a third, an entire line. You can also back up, scroll up and down, and repeat lines, all of which are spoken by the synthesizer. It makes it very easy to insert or delete text, move blocks around, and perform

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Shel Talmy, 11468 Dona Teresa Dr., Studio City, CA 91604.

all other major functions. Hlivjak told me that the program is similar to *WordStar* and claims that it is as powerful.

The database program is just as easy to use and works on a simple hierarchy system. In other words, Cabinet for general category, such as food; Drawer for type, such as Chinese; and File for specific recipes, such as pickled nightingale tongues, Mandarin style.

Now, for what I think is the most remarkable part of this software created for the visually handicapped—it is the most user-friendly I have seen. All vocal prompts are displayed on the screen making it an excellent package for the sighted user as well. I have suggested this to Hlivjak and Sax, and they are considering making it available to the general public.

Drawbacks

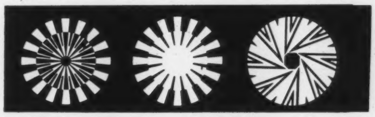
Up to now this sounds like an unqualified endorsement. There are a few drawbacks, which are correctable with some effort. The software runs only on the Osborne 1, which has limited storage space. I would have liked to try the package on my CompuPro. An installation program for other CP/M based systems seems to be a necessity if the company is going to expand. I am told their next project is to convert the software for the IBM PC. Maybe after that...

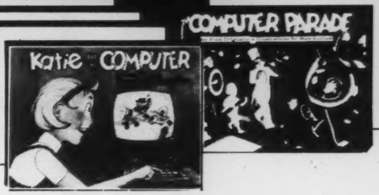
Also, the choice of the Echo GP synthesizer leaves something to be desired in my opinion. Its enunciation is not as good as that of the Intex or the Votrax, for example, all of which are about the same price. However, on a scale of 1 to 10, let's call it 8+.

The software, with the Osborne 1, including Braille keyboard, the Echo, and one year of free program update costs $2,975. The software package alone, with tutorial cassettes costs $1,450. You can write to AVOS, Inc. at 1485 Energy Park Dr., Minneapolis, MN 55108. (612) 646-1515.

I look forward to hearing more from AVOS and other companies like them. It is nice to know that there is a group of innovative people fulfilling the needs of an often overlooked segment of the population. END

At press time, the Osborne Computer Co. filed for protection under Chapter 11. I've phoned the people at AVOS for their comments. They assured me that they have a stockpile of Osborne computers and that they will supply their own warranty in place of the one provided by Osborne.





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CIRCLE 151 ON READER SERVICE CARD

Apple Cart

Stephen Arrants

The first cold spell has struck Morris Plains, bringing temperatures down to a chilly 60 degrees. Of course, as you read this, it is a lot colder! To warm you up a bit, this Cart will present a hearty stew of suggestions, questions and answers. Most of the column will be the First Annual Holiday Wish List. Also, we will have our first contest in a long, long time. So put on a sweater, curl up in front of the fire, and start reading.

The First Annual Wish List

No matter who you are, buying your Apple or Franklin Ace probably took a large chunk of your savings. You got a great deal in return, though—a reliable, well-built, and versatile machine. The trouble is, the poor thing is always hungry. It can never get enough utilities, references, games, peripherals, and other goodies.

This is also the holiday season. If you are tired of receiving yet another sweater from well-meaning relatives, why not give them this column? Who knows? You may get that peripheral you have always wanted, and maybe even another computer user in the family.

Books

THE CREATIVE
APPLE
Edited by Mark Pelczarski and Joe Tate

The Creative Apple, edited by Mark Pelczarski and Joe Tate, is filled with programs, applications, reviews, tips, and even some old Apple Carts. For $15.95 you get a gigantic sourcebook of the best Apple articles from the past three years of *Creative Computing.* Many articles have been updated and revised to take advantage of hardware changes. No matter where your interests lie, this is the book you have been waiting for. *The Creative Apple* contains over 400 pages of the best and most varied Apple reading around. $15.95 from Creative Computing Press.

Better Basic for the Apple by Hume and Holt is a good choice as an introduction to programming in Applesoft Basic. This book will teach you almost all you need to know to write, edit, and run programs on the Apple. There are numerous programming examples, as well as one of the most readable explanations of Apple graphics I have seen. One confusing area in Applesoft programming is the use of data files. Hume and Holt try not to confuse the reader with complicated descriptions of random access and sequential files. The pros and cons of each file type are presented, and it is up to the reader to decide which best fits his needs. $14.95 from Reston Publishing.

At last we have a book that not only tries to decipher *WordStar,* but actually succeeds. *WordStar with Style* by Roger B. White, Jr. goes right to the heart of the question "If *WordStar* is so good, why do so many people hate it?"

There are extensive examples of *how* to use the different functions of *WordStar* and why they work as they do. Chapter two alone is worth the price of the book. Command usage is the main stumbling block to using *WordStar.* It looks so complicated that many people smile at the screen and boot a game. White explains the 20% of commands that you will use 80% of the time. If you use *WordStar* or are thinking about using it, this book will make the process easier. A chapter on different applications includes sample word processing tasks. Help with form letters, reforming text, and using *WordStar* in different situations round out this fine book. If you have ever been afraid of *WordStar,* try this book. $14.95 from Reston Publishing.

Pascal is not my favorite language. Ballyhooed as the replacement for Basic, Pascal makes a valiant effort, but seems to be treading water. If you are the adventurous type, *Pascal Programs for Games and Graphics* by Tom Swan is a good choice. Though not an introductory book, it could be used by a beginner. Swan's way seems to be total immersion—the first program starts on page 4. Three features add to the value of *Pascal Programs.* A Designer program lets you create and edit custom character sets. Credit and Touchup are

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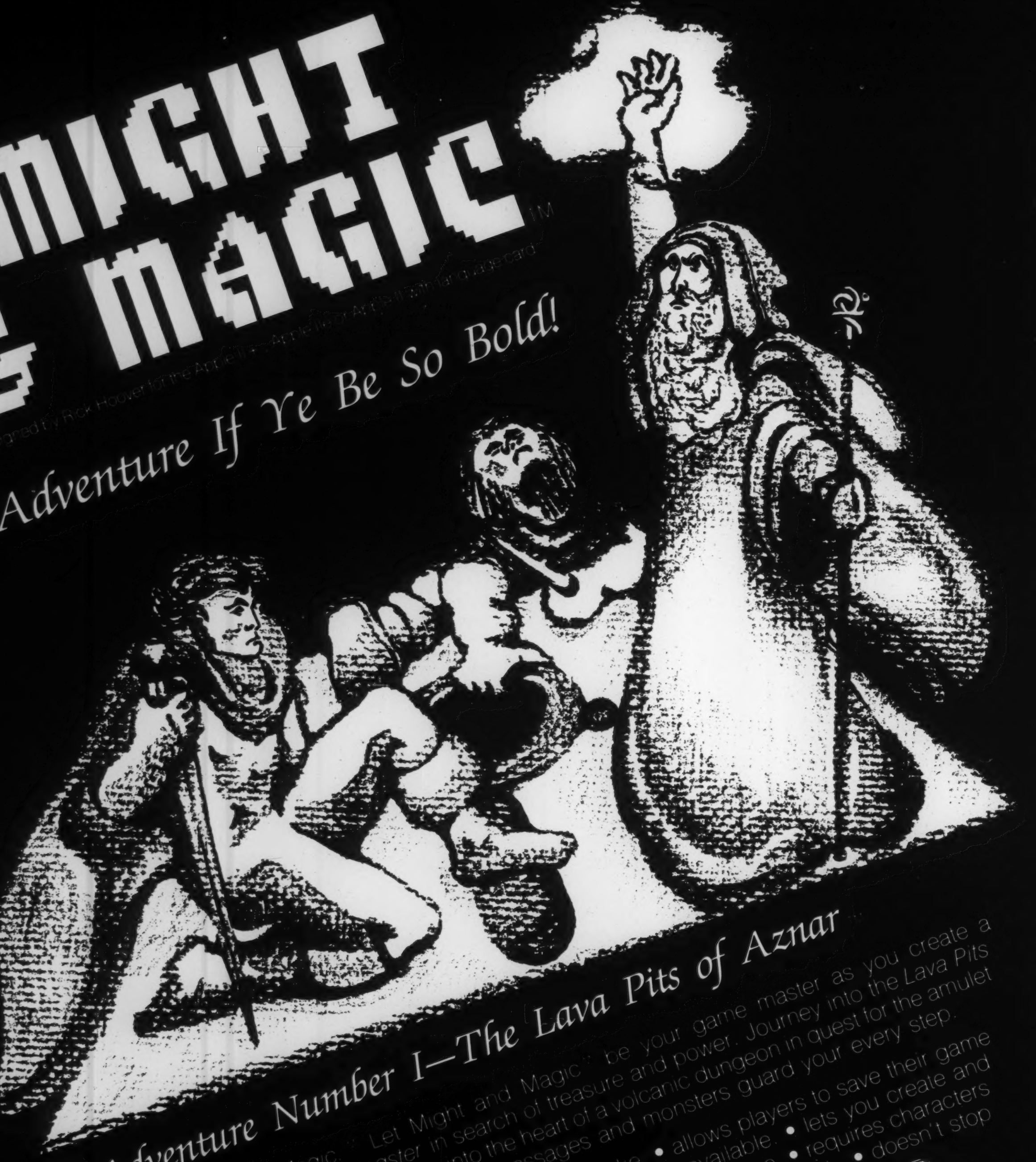

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Apple Cart, continued...

quick and powerful drawing and painting programs. Both can be used to create and edit graphics images pixel by pixel. The author includes his own extension to Pascal, Xtrastuff, which adds extra power and versatility. And for those who get lost, a comprehensive review of every Pascal command is included. 64K RAM is required along with the Apple Pascal Language System. From Hayden Publishing.

One unfortunate fact of computer use is that few packages can be integrated with others. Because of this, Bob Frankston of Software Arts developed the DIF format as a way of allowing easier integration. DIF, or Data Interchange Format, is not a product or software package that you buy. It is, rather a standard way of exchanging data between different computer programs. With DIF, data used in a *VisiCalc* spreadsheet can be used in a *DB Master* application or in *PFS: Graph.* Over 70 different software products use DIF.

The DIF File by Don Beil clears up many misconceptions about DIF and offers case studies on how to transfer data between different programs. This book should be on your shelves if you use any of the popular business packages available. $15.95 from Reston Publishing.

Software

The first software I would recommend for anyone is anything from Beagle Bros. Everything they publish is topnotch. Utilities, games, graphics packages—all worth the money. In addition to a disk, you get a chart of PEAKs and POKEs, a Tip Book or a Tips and Tricks chart. Every disk is unprotected, listable, and can be modified by the user. With so much junk being offered for sale these days, Beagle Bros. products are light-years ahead of the pack. Their products are the only ones I will buy *without* reading a review. Prices range from $20 to $39.50.

Another publisher I recommend without any hesitation is Infocom. From *Zork I* to *Planetfall,* each game is exciting, innovative, and addictive. All are pure text adventures—no graphics at all. You may have to search for an object, investigate a murder, or save an entire planet. These are not games you boot up and finish in an hour. Getting through one adventure can take many weeks. I am still trying to complete *Planetfall* after two weeks of play. If you want games that really challenge you, games which do not insult your intelligence or wallet, try Infocom. Though a bit more expensive than the "twitch" games, you will get more enjoyment out of them. They exercise your mind, rather than your fingers.

Electronic Arts is one of the newest—and best—software publishers. My favorite game of the moment is *Hard Hat Mack.* Though nothing more than a chase game, the nice graphics and the novel premise make this a good game to give or receive. Mack is a construction worker menaced by vandals and an OSHA agent while he works on a high rise building. Mack must complete different sections of the building before moving on to higher levels. Timing is important in this game. You must time Mack's movements precisely on levels two and three. There are also definite patterns to this game. Figuring out these patterns is the first step in mastering *Hard Hat Mack.*

Do you do a lot of Basic programming? Are you spending more time editing and debugging than actually writing programs? *GALE,* the Global Applesoft Line Editor from MicroSparc, Inc., has been upgraded for the Apple IIe. *GALE* is a great help when writing and editing programs. It is almost like a word processor for programmers. You

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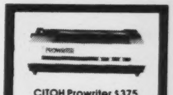
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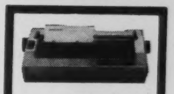
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Apple Cart, continued...

can renumber lines, automatically number the program, cross reference variables, merge programs, and do a global search and replace. Individual line editing is very easy, and you can insert, delete, and compress a line without retyping and recopying the entire line. *GALE* can be used on a 48K or 64K Apple or the Apple IIe, and co-residently with MicroSparc's *Ampersoft* program.

An updated version of *The Graphics Magician* by Mark Pelczarski is now available. All of the routines are faster; the editors are easier to use; and more options are included. Text routines have been added to the Picture editor, and can be used with other programs as well.

Since its introduction in 1981, *The Graphics Magician* has been used to create programs published by other software companies, such as Sierra On-Line, Sir-Tech, and Adventure International.

With *The Graphics Magician* you can create and save on a single disk many multi-colored pictures which can then be recalled quickly in your own programs. This is one of the most flexible graphics packages available for the Apple.

Peripherals and Cards

The *SuperSprite* peripheral card from Synetix Inc. puts real sprite graphics on your Apple or Franklin Ace. Sound effects and speech are included. This is one of the most exciting products for the Apple in quite a while. For $395 you get the peripheral card, an operator's manual, and software. Apple graphics are OK, but for truly amazing sights, check out the *SuperSprite* at your dealer. You can not only have sprite graphics on screen, but also standard Apple graphics at the same time. Programming the sprites is made easier by the software. The Ampersprite programming utility speeds up your job by doing all the difficult tasks. A full review of this innovative product will appear in an upcoming issue. But from what I have seen of it, I would recommend it.

The toughest part of programming is writing a logical, error-free program. The most boring part, however, is entering line after line of commands. It is the same with other computer operations. Somehow, the complicated commands and repetitive tasks get in the way of what we want to do. Keywiz from Creative Computer Peripherals Inc. takes some of the unpleasantness out of using your Apple.

Keywiz is a user definable keyboard featuring 31 keys which can be shifted and unshifted for a total of 62 keys. The memory of the unit can store up to four different keyboard configurations at one time. Unlike other keyboards, Keywiz is complete. You don't have to buy extra PROMs for different applications. With one Keywiz you could have *Apple Writer, VisiCalc,* Basic and Pascal keyboards available at one time.

Installation is tricky, involving disassembly of the case from the motherboard. Once installed, you can forget about it. Keywiz does not have to be disconnected when not in use, and it will not bomb any program. Keywiz is not cheap, either, at $299.

Programming Keywiz is easy. Touch the P key, the key to be programmed, and enter up to eight characters from the keyboard. Touch the P key again, and you have just programmed one key. After programming your first set of commands, you may switch to another keyboard by using the S (for switch) key. An LED at the top of the board indicates what mode you are in and which key is being programmed.

The documentation consists of an installation guide and an instruction booklet. Keywiz is supplied with blank templates to be placed over the keyboard. While the booklet is complete, the installation guide leaves a great deal to

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Apple Cart, continued...

be desired. More than both sides of one page are needed for such a complex operation. Creative Computer Peripherals never tells you that installation of Keywiz could void your Apple or Franklin warranty.

At first, I thought Keywiz was a poor product. After using it for a few weeks, I began to see how useful it can be. The only drawback is the poorly written installation guide for use on the Apple IIe. The instructions for use on the Apple II+ and Franklin Ace are much better. I hope Creative Computer Peripherals comes out with better instructions for the IIe.

News and Notes

Apple Computer has announced its participation in a Community Affairs Program, which will support the formation of microcomputer networks between non-profit organizations. Apple will supply the equipment, software, and training.

For purposes of this program, microcomputer networks are described as cooperative groups which share information by connecting computers through telephone systems. This program is aimed at groups using computers in a communications environment, where they can use electronic mail, conduct teleconferencing, share databases, create community bulletin boards, and take advantage of other services.

For a complete description of the requirements and standards for submitting proposals, contact the coordinator of The Community Affairs Program, Apple Computer, 20525 Mariani Ave., M/S 9L, Cupertino, CA 95014. The telephone number is (408) 996-1010. Grant deadlines are February 15, May 15, August 15, and November 15, 1984.

Apple Computer just won a major lawsuit against companies that make Apple clones. A court ruled that information in ROM *can* be copyrighted and considered proprietary information. No other information was available at press time.

Apple has produced the *Tool Kit* for Logo. The *Tool Kit* offers extensions and utilities for Apple's own Logo package. The *Tool Kit* will be available free to registered Apple Logo owners. Just take some blank disks to your dealer, and he will make copies for you.

Letters

The surveys continue to come in. I am organizing them into a recognizable shape with the help of *DB Master,* which I will review in an upcoming issue. Here are some things you hold in common:

First, most of you are intensely loyal to your Apple or Franklin Ace. There are a few sore spots, such as no numeric keypad on the Apples, high prices, and a dislike of both the Apple and Franklin Ace manuals. Few of you own software that you refuse to boot. Your ages run from 13 to 63, and about one-quarter of you are women. I'll have a statistical breakdown soon.

Many wanted to know how they might go about writing for us. If you have an interesting application or utility, an easier way of doing something we published, or a translation of a program published here, send it in. We look at *everything* that even remotely resembles a manuscript. Do you have a hardware modification? How about undocumented program fixes? We are interested. Typed and double-spaced, please. If it includes a program longer than 20 lines, please send a disk along, too. We will return it if you include an SASE. It may take a while, but you will get an answer.

One reader had complaints about her Apple dealer. It seems that she decided that the Apple IIe was the machine she wanted. At the local computer store, the clerk said that the Apple couldn't run CP/M (wrong), wasn't very good for games (wrong), and was a difficult machine to use (true, if you have recently become deceased). I called her up, to get some further information. It turned out that the clerk was trying to sell her another machine which was more expensive. It also turned out that Apple Computer no longer sells to that store. This store was not a "Mom and Pop" operation. It was large, profitable, and well-known in its area. It is unfortunate that both the owners and workers in these stores underestimate the intelligence of customers. If something like this happens to you, tell Apple. They'll listen to your complaints and put you in touch with a dealer in your area who *knows* about Apples.

Jon Foster of Ann Arbor, MI wanted to know why Computerland stores are dropping the Apple product line. Actually, Jon, I think it is the other way around. Apple will lose some profits, but not a major portion. I got some information the other day in a newsletter that circulates in our offices. One source estimates that 80% of Computerland's sales comes from 20% of its stores. If Apple lost 80% of these and only 20% of the business in these low volume stores, the situation would not be too serious.

As long as key dealers in the chain are happy, the so-called backlash is just sound and fury, but little action. Let's say a store with a volume of $15 million stops selling Apple, and Apple products make up 10% of its sales. $1.5 million against Apple's $1 billion annual volume is probably an acceptable loss. Apple benefits by having better qualified, educated, and loyal dealers. Clearly, Apple is building for the future on a topnotch dealer network. (Note: The anonymous store above was *not* a Computerland.)

A Contest

DISKILL!

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Above is an advertisement for a new product. Readers are invited to submit advertisements for one imaginary product.

Rules: *Postcards only!* One entry per person only should be sent to December Apple Cart, 39 E. Hanover Ave., Morris Plains, NJ 07950. It must be received by January 5, 1984. Editors' decisions are final, and all entries become the property of *Creative Computing.* The winner will receive a software package as yet to be determined. One runner-up will receive a one-year subscription to *Creative Computing.* The results will appear in the April Apple Cart. Foreign postmarks are given two days grace.

Readers can contact me via CompuServe, at 75675,1075. In January, we will have some exciting news about Creative Computing and CompuServe.

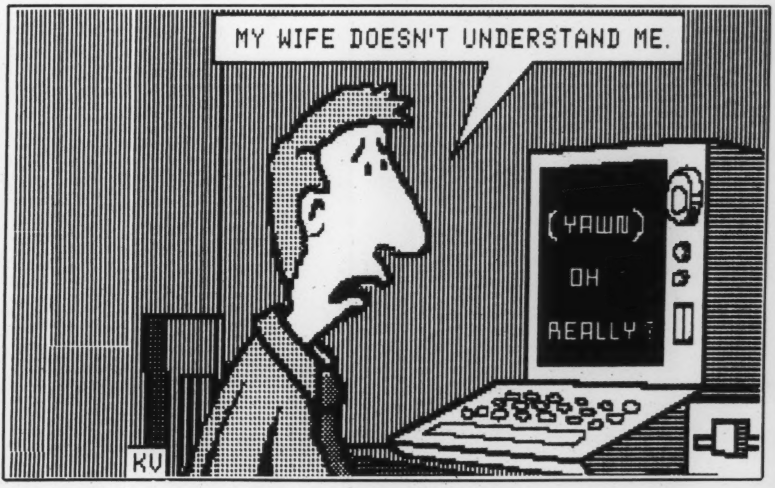
At The Last Minute

Ken Williams, president of Sierra On-Line visited Creative Computing recently. He brought along a copy of *Home Word*, a new word processor that uses icons instead of control codes for commands. Until now, about the only systems that used icons successfully were Apple's Lisa and the Xerox Star.

Designed for the home user and those who do not want to spend all of their time learning to use a computer, *Home Word* is perhaps the easiest word processor to learn to use. Ken claims that it is more powerful and easier to use than *Bank Street Writer.* At a price of $49 for *Home-Word*, Sierra On-Line should give Broderbund a real challenge.

The bottom of the screen shows six icons: Print, a printer; Edit, a page; File, a file cabinet; Format, a ragged page with an arrow connecting it to a neatly organized page; Customize, a question mark; and Disk Utilities, a floppy. Using a joystick or cursor key, you select the icon you wish to use. A second icon display then replaces the first. When you enter text, a representation of the page appears at the lower right of the screen. Words are tiny solid lines with spaces separating words and ending paragraphs. As text is entered, the display is updated. Thus, you can see an approximation of what the final product will look like.

How do I feel about *Home Word*? After using it for a few days, I must admit I was impressed. *Home Word* is so easy to use and well put together that it should be the hit of the market for inexpensive word processing. It can't do everything that *Screenwriter II* does, but for the casual user *Home Word* makes a home computer more accessible, friendlier, and less frightening. I will have a comprehensive review of *Home Word* in January. END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IBM Images

Susan Glinert-Cole

Today is a balmy 105 degrees in Baltimore, and I have been having a difficult time setting the mood for a Christmas column. I contemplated climbing into the refrigerator, but unfortunately it was already occupied by other members of the household who refused to yield to my glib argument about how hard it was to set a tone for December when I could fry an egg on the system unit.

Using a technique often employed by members of the acting profession (method acting), I decorated my feet with ice cubes and pretended to be a Christmas tree. This had an altogether salubrious effect, so without further ado, I proceed to the matters at hand.

Utilities and languages can be as entertaining as games and are usually far more intellectually stimulating. Alas, it is true that some utilities crash more often than they inform, and some compilers are so poorly documented that using them is a little like learning Japanese from sidewalk graffiti. I would rather talk about the better products, so read on.

Coping With The Rule Of Stuff

Everyone has suffered, at one time or another, from the inexorable Rule of Stuff: stuff expands to occupy all available space. Almost everyone has some variety of stuff that multiplies in the dark; our household is particularly plagued by newspapers and plastic bags. Some friends of ours have terrible problems with little soap bars. Victims of the rule mumble a great deal about not knowing where all this stuff came from.

Files, being composed of elemental stuff matter, will naturally expand to occupy all available disk space. Most computer users are plagued by this problem, but there are utilities available that can trim inches away in seconds.

Starside Engineering offers *Compress*, a utility that is very effective in reducing the size of ASCII files up to 50%. Every piece of software I have seen from Starside Engineering is impeccably constructed. Their documentation is readable, informative, and often entertaining; in short, everything software documentation is supposed to be but usually isn't. The software is uncrashable and has excellent human interface. Updates are available for $5 and the original disk. Starside also provides five pre-typed labels for backup copies.

The programs in this package, COMPRESS and DECOMPRESS, are invoked by typing the name after the DOS prompt. If no file is specified as a parameter, each program enters a "command mode" which presents a help screen and an asterisk prompt. The file(s) to be operated on may then be entered. COMPRESS produces a file with the extension .TQT as its output unless the file has no extension to begin with; in this case the extension .QQQ is appended to the original file name.

DECOMPRESS works in a similar manner, but it has a preview option that allows you to inspect a specified number of lines of a file before decompression. The output from this command may be redirected to the printer. As in COMPRESS, multiple files may be specified at once; options are available to print a formfeed between files and insert a carriage return/linefeed pair after each line.

Both utilities are written in assembly language and zip right along. A 15,104-byte file took six seconds to compress to 9224 bytes and about three seconds to decompress. The utilities use Huffman coding, which is based on the principle that some letters of the alphabet occur more often than others.

COMPRESS analyzes a file and creates a table of the ASCII characters found in the file. It then assigns variable-length codes to the characters. The characters found most often, e's and a's for example, become a two-bit code, while the less common ones may take seven or more bits. The translated file, along with the translation table, is written out to the disk.

DECOMPRESS uses the translation table to convert the file back to its original form.

The documentation explains that files containing many vowels and spaces may realize a 60% compression, while files with an even distribution of ASCII characters may derive very little benefit from this utility. Because Basic program files tend to be composed of randomly distributed op codes, COMPRESS may not be able to whittle down the size of a Basic program very much. The manual suggests that it is hard to predict just how well this utility will work on a given file; the only way to find out is to experiment.

The package works with either DOS 1.1 or 2.0, any monitor, and 64K of

---

Susan Glinert-Cole, Suite 211, World Trade Center, Baltimore, MD 21202. Correspondence can only be acknowledged when a stamped, self-addressed envelope has been provided.

memory. Starside Engineering also offers a screendump utility, *Frieze,* and a graphics scratchpad program, *Glyphix,* that I hope to look at next month.

The Basic Development System

SofTool Systems has put together a wonderful package for the Basic programmer. BDS requires 64K of memory and will work with either DOS 1.1 or DOS 2.0; in both cases it is called from DOS and runs Basic(A) as a subtask. The installation procedures differ for each version of DOS. For DOS 2.0, BDS is simply copied to the working disk; for DOS 1.1, a set of patches is included to modify Basic or BasicA. In either case, the user has the option to run BDS as a disk or memory resident module. Once installed, the facilities provided by the seven utilities become an integral part of the Basic command set and are used transparently by the programmer.

BDS is called by entering the following command after the DOS prompt:

BDS m [X] [.[d:] [p]] b

where m specifies Memory or Disk resident mode; X is an optional parameter for the extended Cross-Reference format; ".", "d:", and p tell BDS where to look for the BDS.COM file if the program is being used with the disk resident mode. The b is a command line for starting Basic(A) and is entered exactly as it would be if BDS were not present. The command:

BDS D BASICA

would start advanced Basic with BDS in the disk resident mode; the program would expect to find BDS.COM on the default drive and current directory. It is possible to run Basic(A) without BDS by specifying a switch in the command line.

The documentation is excellent and comes punched for insertion into the Basic manual. A quick reference card is thoughtfully provided, and the manual has some nuggets of information about Basic that are not readily available elsewhere.

The XBasic utility accepts one letter abbreviations for ten standard Basic commands and a new one provided by SofTool. The screen can be cleared by typing a C (for CLS). L lists a program. N clears the workspace, and so on. The command UN-NEW (U) restores the resident Basic program if you cleared the workspace unintentionally.

XBasic lets you step through a program line-by-line in several different ways. CTRL-PgUp lists the first line, PgDn lists the next line, PgUp lists the previous line, CTRL-PgDn lists the last line, and . lists the current line of a program. These commands are meant to be used in conjunction with the single step trace facility which is invoked with:

SYSTEM TRON [line number]

This command, and its opposite number SYSTEM TROFF, may be used inside a program or in the direct mode. Prior to executing a statement, the trace option will display the line number of the statement in the upper righthand corner of the screen, and execution is suspended until a key is pressed. The keystroke is left in the keyboard buffer to allow INKEY$ and INPUT statements to be processed normally. CTRL-Break halts the program in the usual fashion, and other BDS debugging tools can then be called into play.

The state of all program variables can be examined with the Variable Dump Facility. There are eight formats for the V command, which allow you to specify selected variable listings and direct the output to the screen or the printer. The variables are displayed, followed by the data type (single precision, integer, and so on) and the current value.

The FIND utility (F) is similar to the Variable Dump, but produces listings of Basic keywords and strings alongside the line numbers where they are located. Listing 1 is a listing of a program entitled Nonsense; one result of FIND on Nonsense is shown in Listing 2.

XREF outputs a list of any or all constants and variables, cross-tabulated by line number. If the variable has been modified on that line, the line number is preceded by an asterisk. There are two different output formats for XREF and FIND; selection is done by specifying a parameter at the time BDS is invoked. Listing 3 is the default XREF output, and Listing 4 shows the extended cross reference format.

SUPER RENUM renumbers lines in ways that MicroSoft never dreamed of. It allows you to specify an upper limit on a block of lines to be renumbered, lets you relocate or duplicate sections of the program, and keeps you informed as to

```
10 '                          Nonsense Sample
30 '
35 DEFINT C-F
40 STUFF$ = "holly berries"
50 FOR POTATO = 1 TO 12
60   PRINT " You are in a twisty maze of DOS commands, all alike"
70 NEXT POTATO
80 '
90 DIM LIGHTS (13)
100 GOSUB 200
110 '
120 PRINT "enough already"
130 END
190 '
200 FOR BULB = 1 TO 13
210   LIGHTS(BULB) = BULB
230   IF LIGHTS(BUB) < 13  THEN PRINT "hello sailor"  ELSE PRINT STUFF$
265 NEXT BULB
270 RETURN
```

Listing 1.

```
            BASIC Development System - output from FIND command

-                35
<               230
=                40      50      200     210
DEFINT           35
DIM              90
ELSE            230
END             130
FOR              50     200
GOSUB           100
IF              230
NEXT             70     265
PRINT            60     120      230     230
REM              10      30       80     110     190
RETURN          270
THEN            230
TO               50     200
```

Listing 2.

```
         BASIC Development System Cross Reference Output

1       50 200
12      50
13      90 200 230
*200    100
BUB     230
BULB    *200 210/2 265
C       35
F       35
LIGHTS  90 *210( 230(
POTATO  *50 70
STUFF   *40/$ 230/$
```

Listing 3.

- **DISPLAYS CORRECT SPELLINGS:** If you don't know the correct spelling, EW will look it up for you, and display the dictionary.
- **VERIFIES CORRECTIONS:** If you think you know the correct spelling of a word, EW will check it for you before making the corrections.
- **HYPHENATES AUTOMATICALLY:** (Optional). Inserts discretionary hyphens throughout text.
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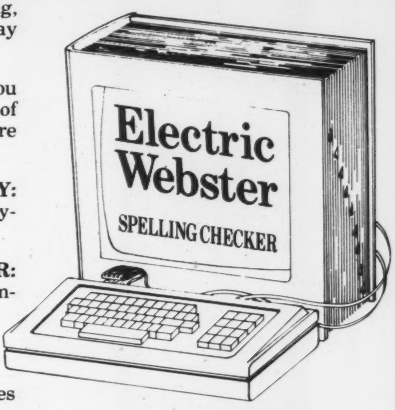

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the number of program lines and text size before and after it executes. With this program you can even change the order of program lines with one renumbering command.

The last two utilities, COMPRESS and UNCOMPRESS, are specifically for use with Basic programs (as opposed to ASCII text as in Starside Engineering's *Compress*). COMPRESS squeezes out all extraneous blanks, colons, remarks, trailing quotation marks, non-executable program lines, and so on; in the process it reduces the size of the program to the minimum required for optimal program execution. By following COMPRESS with various parameters, the compression process can be tailored to your own specifications. Thus if you don't want blanks or remarks removed, you can instruct COMPRESS to leave them in.

The function of UNCOMPRESS should come as no surprise; it reverses the actions of COMPRESS, with some modifications. If remarks were removed, this utility cannot replace them. Again, the expansion process can be tailored to your own particular taste in spacing, indentation, and variable typing characters.

The set costs $79 and is well worth the price. It is one of those pieces of software you will wonder how you ever did without.

```
                BASIC Development System  - Extended Cross Reference Output

1                   50    200
12                  50
13                  90    200     230
*200               100
BUB                230
BULB               200*   210     210     265
C                   35
F                   35
LIGHTS(             90    210*    230
POTATO              50*    70
STUFF$              40*   230
```

Listing 4.

```
10 '                     Nonsense Sample - slightly squashed
30 '
35 DEFINT C-F:STUFF$="holly berries"
50 FOR POTATO = 1 TO 12
60 PRINT " You are in a twisty maze of DOS commands, all alike"
70 NEXT POTATO
80 '
90 DIM LIGHTS (13):GOSUB 200
110 '
120 PRINT "enough already"
130 END
190 '
200 FOR BULB = 1 TO 13
210 LIGHTS(BULB) = BULB
230 IF LIGHTS(BUB) < 13  THEN PRINT "hello sailor"  ELSE PRINT STUFF$
265 NEXT BULB
270 RETURN
```

Listing 5.

```
File: junk.bas                                                    Page     1

   10 '                     Nonsense Sample - Output from PrettyPrinter
  30 '
  35 defint C-F:
     STUFF$="holly berries"
  50 for POTATO = 1 to 12
  60   print " You are in a twisty maze of DOS commands, all alike"
  70 next POTATO
  80 '
  90 dim LIGHTS (13):
     gosub 200
 110 '
 120 print "enough already"
 130 end
 190 '
 200 for BULB = 1 to 13
 210   LIGHTS(BULB) = BULB
 230   if LIGHTS(BUB) < 13
          then print "hello sailor"
          else print STUFF$
 265 next BULB
 270 return
```

Listing 6.

Prettyprinting

PCTools offers a duo of utilities for PC Basic: *PrettyPrinter* and *Cross-Reference*. The documentation and the programs themselves are excellent. The author spices the manual with charming digressions on code legibility, strengths and weaknesses of IBM languages, and programming philosophy; there are also some little-known facts about Basic scattered around. The pretty printer transforms your ugly (but compact and efficient) program into a readable and tasteful listing. Multi-line statements are properly disentangled and each statement is printed on its own line. Basic keywords are transformed to lowercase, and block conditional statements (if . . . then . . . else and while . . . wend) are given a Pascal-like structure. Remarks may be highlighted either with boldface type or by separating them from the body of the text with any chosen character. Listings 5 and 6 show what *PrettyPrinter* can do to an efficient, but unsightly program.

The *CrossReferencer* is not quite as powerful as that which comes with BDS, but it is easier to use, and the output is much tidier (see Listing 7). You can cross-reference by variables, line numbers, and keywords; these options are chosen from a menu when the program is run. The two programs cost $39 on one disk and are a good buy.

Name That Disk

I hate formatting disks. I simply cannot get interested in feeding little plastic frisbees into the maw of a disk drive and "pressing any key to continue." My aversion to the process is so strong that I usually format two boxes of disks at once, so as to have a plentiful supply on hand. While the drive is creaking and groaning, I can eat a couple of pounds of grapes. This state of affairs makes it impossible for me to give the disk meaningful volume names and, while it was a nice touch to include this facility in DOS 2.0, the fact that a volume name cannot be added or altered after formatting is very inconvenient. ErgoSoft offers a nifty little utility, *PCDiskid*, that can manipulate volume labels (add, delete, or change), unerase a program, and print a sorted directory listing. The programs will work on a fixed or floppy disk and require DOS 2.0 or higher.

The documentation, a well-written little pamphlet, is almost unnecessary, because the program is completely self-explanatory. The menu presents five choices: Add/Change a volume label, Delete a volume label, Unerase a file, List a sorted directory, and Exit to DOS. If you choose to add or change a volume label, the program displays the current label (if present) and prompts for a new name. If you choose the delete option, a confirm prompt ensures that the erasure is not done accidentally. The unerase utility attempts recovery of the specified filename, but because DOS erases a file by changing the first letter of the file, filenames that are identical except for the first character cannot be distinguished (e.g. 1FILE and 2FILE). *PCDiskid* resolves the conflict by recovering the file with the most recent directory date.

The directory listing utility will generate an alphabetical list of all files on the disk, including hidden and system files, in four different formats. Three of the formats are suitable for viewing: five or nine filenames per line and the regulation DIR output. The output of these three choices may be directed to the display or the printer. The fourth option is a label format (4" x $1^7/_{16}$"); printing will continue on consecutive labels until all the filenames are printed.

There are no unpleasant surprises in this package; it is fast, friendly, and an excellent buy at $30. ErgoSoft is working on a larger set of utilities for the IBM PC. Given the high quality of this piece of software, I look forward to seeing their next offering.

What The Best-Dressed Computers Are Wearing

The appurtenances of computers fade in and out of fashion with a rhythm reminiscent of the Seventh Avenue hemline oscillation. Every year it seems, produces a modish new language, database, word processor, hardware appliance, and ergonomically designed disk container. The blinding speed with which the computer industry progresses relegates your system to obsolescence almost before the last shreds of packing material have been picked out of the disk drives. It is interesting to follow the meteoric ups and downs of these fashionable items and speculate on tomorrow's electronic hemline.

Computer enthusiasts will usually argue in a persuasive, albeit polite, manner about their pet spreadsheet or utility, but for some reason, when the discussion turns to favorite programming languages, the urbane and polished *bon mots* degenerate into scurrilous diatribes. I don't think there is another subject that arouses the chauvinistic nature of a programmer the way languages do. People are even classified by their native computer tongue as in: "Oh, *he* programs in *Basic*..." (said with a disdainful curl of the lip). The best way to counter the question of what programming language you use is to say "Well, it depends..." This will imply that you are familiar with at least five of them and is a good status symbol.

```
    Output from PCTools' CrossReference Utility

File: junk.bas                                              Page: 1

===========================================================================
Referenced
Line Numbers    Appearing on lines...
---------------------------------------------------------------------------
   200           90
===========================================================================
Variables        Appearing on lines...
---------------------------------------------------------------------------
BUB              230
BULB             200    210    265
---------------------------------------------------------------------------
LIGHTS()          90    210    230
---------------------------------------------------------------------------
POTATO            50     70
---------------------------------------------------------------------------
STUFF$            35    230
```

Listing 7.

I feel somewhat obliged to keep the readers of this column *au courant* of languages, fashionable or otherwise, lest they have nothing to argue about at user's group meetings. Let's begin with Ada.

Ada

Ada, as everyone probably knows by now, was commissioned by the Department of Defense to help keep costs down in the DoD's computer centers. The rationale is that different departments have been writing programs in several assorted languages, making maintenance difficult and portability impossible. With only one language to contend with, the price of electronically defending the U.S.A. should, theoretically, plummet accordingly.

Ada is not well regarded by Those Who Know Computer Languages, because it is complex, difficult to use, and has all of the warts associated with a language designed by a committee. Ada will be about as fashionable and well loved as Cobol, another DoD creation. Regardless of the prevailing opinions about it, programmers who learn it will have an advantage job-wise over those who don't.

There are several compilers for the IBM PC on the market which are subsets of Ada. Be aware, however, that the DoD will not allow a subset to be called Ada; only fully validated compilers can use the name. The two compilers I am aware of at the present time are Supersoft's Ada and RR Software's Janus/Ada. Both companies eventually intend to upgrade their products to fully validated implementations.

C

By far the most fashionable language of 1983 is C. There are at least a dozen C compilers on the market for the IBM PC, and more leap into the fray every month. I have done very little programming in C, and so have only a bystander's view of it. C contains many facilities, such as bit-manipulation operators and pointer arithmetic, that make it easy to control low-level machine functions and can provide a very rich set of data structures.

The model supplied by C is inherently flexible; this allows extensions to the language, as well as adaptation to different machines to be easily done. It is no wonder that C is enormously popular with system developers. The ability to remain close to the machine model while coding in a high-level language is certainly appealing; many programmers, system developers, and software houses are busily converting everything in sight to C.

The opponents of C, when they dare come out into the open, say the C has wishy-washy type checking, produces unreadable source code, and is not really as portable as it is advertised to be. C is very popular with assembly language programmers, but most Pascal adherents find it uncomfortable to use, I guess because its laxity in type-checking allows the user to commit truly spectacular programming errors.

Let us not forget, however, that Unix (and Xenix) are written primarily in C. If MS-DOS is upwardly compatible with Xenix, it doesn't take much to figure that IBM will be soon offering their own C compiler. In fact, Microsoft has converted much of their program development to this language, and already offers Lattice C under their own label. If the language doesn't appeal to you, memorize a few buzzwords. At least it is easy to spell.

Modula-2

I really didn't mean to mention C and Ada; I started talking about fashion primarily as a lead-in to another language altogether: Modula-2. Modula-2 is Niklaus Wirth's answer to Ada as Pascal was his answer to Cobol. Because I think both of his languages are remarkable, I can doubly admire his backchat to the Department of Defense. Modula answers many of the objections to C, such as cryptic code and lack of type-checking, while still allowing flexible, low-level programming.

Modula-2 was designed, in part, to address some of the sticky wickets of Pascal. Not surprisingly, the two languages are remarkably similar and share an underlying common structure and syntax. The module concept is central to the language, allowing large programs to be written in smaller pieces called (surprise!) modules. Parts of the module may be designated as visible to the outside world, while other sections are sheltered inside the module.

This philosophy has many advantages, particularly when many people are contributing to a large programming project. For example, machine-specific information can be hidden in the body of the module, while a high-level interface is publicly presented. This makes it relatively easy to transport a program to other machines, because only the machine-specific portion, and not the interface, need to be rewritten.

Like C, Modula has the facilities for low-level machine access, such as pointer and address arithmetic, interrupt handling, direct access to memory, and relaxed type-checking. Modula supports co-routines, which can be viewed as processes that execute independently and call each other as co-routines. This provides the concurrent processes and task scheduling so dear to the hearts of systems programmers.

Pascal programmers will thrill to Modula's dearth of BEGINs and ENDs; they will also enjoy the addition of the LOOP command. Less pleasant is Modula's WRITE statements: a separate WRITE is needed for each data type (e.g., WriteReal, WriteString, and so on). This makes output a drag to code.

Volition Systems offers Modula-2 running under the UCSD p-System ver.2.0. Logitech is rumored to be producing a version that will run under DOS 2.0. I have only seen Volition's version, and it is admirably done. The package includes Niklaus Wirth's book *Programming in Modula-2,* the Modula compiler, a Pascal compiler, an excellent editor, a library of utilities, and one of the best language tutorials I've ever seen.

A programmer conversant in Pascal can be writing Modula programs in a couple of hours with Volition's kit. However, it is not inexpensive at $595, and programs written in this language must, by virtue of the odd operating system chosen, be stand-alone programs. The rumor is that Volition will be converting the compiler to run under MS-DOS. I hope this rumor has some substance, because the volume of applications programs written in MS-DOS would only enhance the usefulness of this well-designed package.

A Note On SHELL

In DOS 2.0 it is possible to invoke a secondary command processor that will be loaded in place of COMMAND.COM with:

```
A> SHELL = "filename"
```

This command is useful to system programmers who are knowledgeable in the ways of operating systems. Of interest to Basic programmers is the fact that SHELL is also a new keyword in Basic 2.0 and can be used inside a program to carry out commands from DOS. This sounds like a swell enhancement, but unfortunately, it seems to have some bugs in it.

Type in this small program:

```
10 x=42; y=73
20 shell "DIR"
30 cls:print x,y
40 end
```

When run, the program will exit to DOS at a secondary command level, print the default disk directory, return to the program, and execute line 30. The following program is even more flexible:

```
10 shell
20 end
```

SHELL without any parameters will return you to DOS where, to all intents and purposes you can do anything you usually do from DOS, like erase files, format disks and so on. To return to Basic, type EXIT after the A> prompt. You cannot return to Basic by typing Basic; this gives the curious (and undocumented) error: "you cannot run Basic as a child of Basic." SHELL itself can be used any number of times inside a program with no ill effect. This really seemed whiz-bang neato, until I tried to list the program. This action produces various unpredictable results consisting mostly of screen garbage, an occasional system crash, and some flashy visual displays. The junk can be cleared out of the program space with NEW, but typing SHELL again (even in a program line) will usually freeze everything and require a cold reboot. SHELL is probably meant to be used in invoking a secondary command processor from Basic; using it with COMMAND.COM itself leaves the program workspace in a mess after the program has finished running.

A Little Christmas Spirit

The small program listing (Listing 8) called Reindeer is by way of a small Christmas present to the column readership. It will print out a mildly artistic decoration that can be used either as a weird ornament or as a bulky Christmas card. The printout looked extremely boring in black and white, so I was impelled to find a way to wring something more colorful out of my printer without investing a small fortune.

I understand, from some of the statistics floating around the office, that some overwhelming percentage of the people reading these words are of the masculine persuasion; consequently, the item that does the trick (dressmaker's carbon paper), will probably not be in your vocabulary. This stuff is found in stores that carry sewing supplies. The best kind is made by Dritz; it has a thick, waxy coating and comes in six or eight different colors. Some dressmaker's carbon paper looks like blueprint paper and it won't work because the coating is too thin.

Anyway, the general procedure is to obtain a long sheet of either boring, white printer paper or some dazzling shade of wrapping paper cut to fit the printer and place a sheet of the carbon paper, *waxy side down,* on top of the first sheet. Roll the whole thing into the printer and run the Reindeer program. Multi-colored animals will prance down the page. It looks particularly nice with white reindeer on dark blue paper. Merry Christmas.

Correction

The last section of the Format Program for the NEC 8023A was omitted from the October column. The missing lines appear in Listing 9.

VIDEO GAMES
NEW and USED
INVADERS
CYCLONE
USED in GOOD CONDITION

"...Now this magazine was owned by a little ol' lady that couldn't get through the first rack..."

Listing 8.

```
10 '                         ** REINDEER **
20 '                           Susan Glinert-Cole
30 '                             December, 1982
40 '
50 'This program prints a bunch of reindeer
60 '
70 MESSAGE$="SAMTSIRHCYRREM"
80 B$ = " "
85 '
90 '===> NOTE: line 100 will differ for each printer
100 LPRINT CHR$(27);"B"  '1/8 " line spacing
120 FOR X = 1 TO LEN (MESSAGE$)
130     C$=MID$(MESSAGE$,X,1)
140     GOSUB 190
150     LPRINT
160     NEXT X
170 END
180 '
190 ' SUBROUTINE FOR PRINTING REINDEER
195 '
200 LPRINT TAB(12);C$;C$;B$;C$;C$
210 LPRINT TAB(12);C$;B$;B$;C$
220 LPRINT TAB(12);C$;B$;B$;C$
230 LPRINT TAB(12);C$;B$;B$;C$
240 LPRINT B$;B$;B$;C$;SPC(8);C$;C$;B$;C$;C$
250 LPRINT C$;C$;C$;C$;SPC(9);C$;C$;B$;C$;C$
260 LPRINT B$;B$;B$;C$;C$;B$;B$;B$;B$;C$;C$;C$;C$;B$;B$;C$;B$;C$
270 LPRINT B$;B$;C$;C$;C$;B$;B$;B$;C$;C$;C$;C$;C$;C$;C$;C$;C$;C$
280 LPRINT B$;B$;B$;B$;C$;C$;B$;C$;C$;C$;C$;C$;C$;C$;C$;C$;C$
290 LPRINT B$;B$;C$;B$;B$;C$;C$;C$;C$;B$;B$;C$;C$;C$;C$;C$;C$;C$
300 LPRINT C$;C$;C$;C$;B$;B$;C$;C$;C$;C$;B$;B$;C$;C$;C$;C$;C$;C$;C$;
310 LPRINT B$;B$;B$;C$
320 LPRINT B$;B$;B$;C$;C$;C$;C$;B$;C$;C$;B$;B$;B$;C$;C$;C$;C$;C$;C$;
330 LPRINT B$;B$;B$;C$
340 LPRINT B$;B$;B$;C$;B$;B$;C$;C$;C$;C$;B$;B$;B$;C$;C$;C$;C$;C$;C$
350 LPRINT TAB(9);C$;C$;B$;B$;B$;C$;C$;C$;C$;C$;B$;B$;B$;C$
360 LPRINT TAB(10);C$;B$;B$;B$;C$;C$;C$;C$;B$;B$;C$;C$
370 LPRINT TAB(13);C$;C$;C$;C$;C$;B$;C$
380 LPRINT TAB(13);C$;C$;C$;C$;B$;C$
390 LPRINT TAB(13);C$;C$;C$;C$;B$;C$;C$
400 LPRINT TAB(13);C$;C$;C$;C$;C$;B$;C$;C$
410 LPRINT TAB(13);C$;C$;C$;C$;C$;C$;B$;C$;C$;B$;B$;C$
420 LPRINT TAB(14);C$;C$;C$;C$;C$;C$;B$;C$;C$;C$;C$
430 LPRINT TAB(15);C$;B$;B$;C$;C$
440 LPRINT TAB(14);C$;C$;B$;B$;B$;C$;B$;B$;B$;B$;C$
450 LPRINT TAB(19)C$;C$;C$;C$;C$;C$
460 RETURN
```

Listing 9.

```
7000 RESUME
7995 '
7996 '--------------------------------------------------------------------------
7997 '                <<<<<<      SKIP TO NEXT PAGE        >>>>>>
7998 '
8000 FOR X = 1 TO 10
8010      PRINT #2,CHR$(10)
8020 NEXT X
8030 LINES = 4                                               'reset counter
8040 RETURN
9995 '
9996 '--------------------------------------------------------------------------
9997 '                <<<<<<      SUPERSCRIPT ROUTINE      >>>>>>
9998 '
10000 CHAR$ = INPUT$(1,#1)                           'get next char
10005 WHILE NOT EOF(1)
10006   IF CHAR$ = " " OR CHAR$ = CHR$(13) THEN RETURN
10010   EXPONENT = ASC(CHAR$)-48                     ' convert to integer
10020   PRINT #2, CHR$(POWER(EXPONENT));             'look it up and send it
10040   CHAR$ = INPUT$(1,#1)                         'get next char
10050 WEND
10060 RETURN
10901 '
11995 '
11996 '-------------------------------------------------------------------------
11997 '                <<<<<<      TABLE CONVERSION ROUTINE    >>>>>>
11998 '
12000 ROW = ASC (CHAR$) - 127                          'get the row code
12010 '
12020 FOR COL = 1 TO 4                                  'get the sequence
12030   IF TABLE (ROW,COL) <> 0
          THEN  PRINT #2, CHR$( TABLE (ROW,COL));
12040 NEXT COL
12050 '
13000 RETURN
14000 '-------------------------------------------------------------------------
14001 '
15000 '                  <<<<<      DATA           >>>>>
15001 '
15005 '             NEC ASCII CODES FOR SUPERSCRIPTS
15006 '
15010 DATA 220,199,204,177,179,180,181,212,213,214
15020 '
15025 '
15030 '             CONVERSION TABLE : IBM PC to NEC PRINTER
15040 '
15050 DATA 0,0,0,0,0,0,0,0,131,8,39,0,97,8,94,0,0,0,0,0,97,8,96,0
15060 DATA 97,8,219,0,99,8,44,0,101,8,94,0,0,0,0,0,101,8,96,0,0,0,0,0
15070 DATA 105,8,94,0,105,8,96,0,0,0,0,0,65,8,219,0,69,8,39,0,0,0,0,0
15080 DATA 0,0,0,0,111,8,94,0,0,0,0,0,111,8,96,0,117,8,94,0,117,8,96,0
15090 DATA 0,0,0,0,0,0,0,0,0,0,0,0,99,8,150,0,76,8,149,0,89,8,224,0
15100 DATA 80,8,116,0,102,8,159,0,97,8,39,0,105,8,39,0,111,8,39,0,117,8,39,0
15110 DATA 110,8,126,0,78,8,126,0,97,8,128,0,111,8,128,0,0,0,0,0,152,148,0,0
15120 DATA 148,153,0,0,168,0,0,0,175,0,0,0,0,0,0,60,60,0,0,62,62,0,0,0,0,0,0
15130 DATA 0,0,0,0,0,0,0,0,150,0,0,0,146,0,0,0,227,0,0,0,146,151,0,0
15140 DATA 145,153,0,0,224,136,0,0,154,8,153,150,150,150,0,0,153,8,148,150
15150 DATA 155,8,128,150,144,155,0,0,224,150,0,0,153,0,0,0,154,0,0,0
15160 DATA 144,0,0,0,145,0,0,0,147,0,0,0,148,0,0,0,143,0,0,0,225,0,0,0
15170 DATA 136,147,0,0,154,144,0,0,136,148,152,0,155,154,8,128,153,154,8,148
15180 DATA 136,225,0,0,224,0,0,0,0,0,0,0,144,8,149,0,155,154,8,149
15190 DATA 145,148,0,0,153,152,8,149,154,149,0,0,154,149,8,128,152,224,0,0
15200 DATA 152,145,0,0,150,151,8,148,226,0,0,0,155,0,0,0,152,0,0,0,135,0,0,0
15210 DATA 132,0,0,0,139,0,0,0,0,0,0,0,0,0,0,0,192,0,0,0,195,0,0,0,187,0,0,0
15220 DATA 202,0,0,0,191,0,0,0,184,0,0,0,223,0,0,0,207,0,0,0,216,0,0,0
15230 DATA 198,0,0,0,186,0,0,0,189,0,0,0,176,0,0,0,216,0,0,0,182,0,0,0
15240 DATA 0,0,0,0,224,148,0,0,200,0,0,0,161,0,0,0,164,0,0,0,0,0,0
15250 DATA 0,0,0,0,166,165,162,0,210,0,0,0,219,0,0,0,166,0,0,0,166,0,0,0
15260 DATA 211,206,0,0,0,0,0,0,0,0,0,0,0,0
```

Firms Mentioned in this Column

RR Software
P.O. Box 1512
Madison, WI 53701

Supersoft
P.O. Box 1628
Champaign, IL 61820

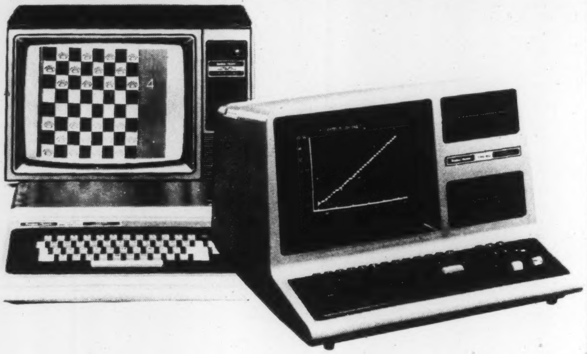
ErgoSoft
P.O. Box 454
Oakhurst, NJ 07755
(201) 493-8352

Starside Engineering
P.O. Box 18306
Rochester, NY 14618
(716) 461-1027

PCTools
Box 207
Centerville, MD 21617

Volition Systems
P.O. Box 1236
Del Mar, CA 92014

SofTool Systems
8972 Hampden Ave.
Suite 179
Denver, CO 80231



TRS-80 Strings

Stephen B. Gray

The fifty-eighth verse of the haunting "Ballad of the TRS-80" tells the tale of two new Color Computers, a full-screen text editor, a Basic compiler, a genealogy program, and a short program that generates random number series.

Color Computer 2

Now there are two new Color Computers: the Color Computer 2, an improved version with a compact white case and an electric typewriter keyboard; and a new version of the old "Chiclet"-key unit, also with a typewriter-type keyboard. The Chiclet-key model will disappear from Radio Shack stores when current stocks are gone. (The TRS-80 Micro Color Computer MC-10 stays in the line.)

The Color Computer 2 comes in two models: 16K Standard for $239.95; 16K Extended for $319.95. All Color Computer 1 programs run on the 2, which has no new software features; the differences are the keyboard, case, and lower price.

The other new machine has the same design of case as the Color Computer 1, but in white. It has the new keyboard, costs $399.95, and is a 64K Extended Basic Color Computer when used with the OS-9 disk operating system. Without OS-9, you can access only 32K of memory.

That new OS-9, by the way, includes an editor/assembler and supports multitasking. OS-9 is said to be similar in syntax and structure to Bell Labs' Unix.

Multi-tasking means that more than one task is being run at a time. Actually, only one runs at a time, but the resources of the computer are split between the various tasks, so you get the illusion that many things are happening at once.

Multi-tasking on the Color Computer is not very effective, because of the slow speed (0.894 MHz) of the machine. However, Unix-type syntax is becoming a standard, so learning OS-9 won't hurt if you want to keep up with the world.

Both the Color Computer 2 and the 64K Extended Basic Color Computer have the new white cases that are now standard for all TRS-80 computers (except Pocket Computers); the color is molded in, not sprayed on.

The white (actually, it is more of an off-white) case for the 64K Extended Basic Color Computer is the same case found on the TDP model. This Tandy Data Products machine, the same as the Chiclet-key Color Computer but with the white case, has been supplied to RCA for sale by RCA distributors to their dealers.

Color Computer Peripheral Incompatibility

Two of the Color Computer 1 peripherals won't work with the new model. There is a slight electrical difference in the two machines: one has a 12-volt line to the Program Pak slot; the other doesn't.

As a result, there are disk drives for both models which are not swappable. Both models are $399.95 for drive 0; $279.95 for drives 1, 2, and 3.

The $349.95 Color Computer Graphics Tablet, when used with Color Computer 2, requires the Multi-Pak Interface, a $179.95 peripheral that lets you switch quickly from one Program Pak to another. You can plug up to four Paks into the Multi-Pak Interface, which in turn is plugged into the Color Computer. Just flip the switch on the interface, and the Program Pak you select is connected to the computer.

Full Screen Text Editor

If you do a lot of editing of your Basic programs, you should look into full-screen text editors, which are much faster than using EDIT, line by line, to make changes and corrections, and which have a great many more features.

Some packages include a screen editor, such as the Sams *Superkeys* program (Sept. 1983, p. 303), which provides a variety of screen editing functions, but not nearly as many as a program designed specifically for the job.

Computer Applications Unlimited specializes in utility packages for the TRS-80. CAU offers screen editors for Basic and assembler, as well as *T-ZAL* (tape-based Z80 assembler), *M-ZAL* (disk-based assembler), *XBUG* (machine language monitor and debugger), *FILEXFER* (communications package), and several others.

CAU's *Full Screen Text Editor* is a word processor specifically designed to handle Basic programs instead of letters and documents and offers an amazing variety of features with its 31 commands. You can change, insert, and delete a character or characters; extend a line or insert lines; delete, copy or move statements; do a global search and/or change any specified string; renumber lines; and scroll by line or page.

Also, each of the 26 letter keys is defined as a macro key to represent a Basic keyword; any or all can be changed.

Using The Screen Editor

Any time you are working with a Basic program and want to get into screen edit mode, just enter XEDIT, and you are ready to edit. Arrow keys, used with and without SHIFT or ENTER, provide six cursor movement commands. To delete a character, move the cursor to it, hit SHIFT, the down-arrow, and D. The character disappears, and the rest of the characters in the line move to the left to fill the gap.

To copy or move statements (or blocks of statements), you get into Clear Command mode by hitting CLEAR. With C you mark a statement to be copied; M marks one for moving. Then move the cursor to where the copied or moved statement is to go, hit H, and that's it. This editor even assigns new line numbers to copied or moved (or inserted) statements, automatically, with a line number 5 greater than the preceding line number. You can change that increment to any value you desire. Or you can renumber the entire program, starting with any line number you wish, and using any increment value you want.

You can search for a statement, which scrolls the display to any point in your program. Just type in

S270

and the display scrolls so line 270 is at the top of the screen. If there is no line 270, you get a message

NOT FOUND

which is the same message displayed if the editor doesn't find a character string in the program. Type

FC=

and the display is scrolled so that the first line that contains this string (C=) is at the top.

When you are at the first occurrence of a string, you can make a global replace. To change all PRINT statements to LPRINT, just scroll to the top of the display, get into the Extended Command mode by hitting CLEAR and the spacebar, type

FPRINT

and the display scrolls to the first occurrence of PRINT. Now get into Extended Command again, type

CLPRINT

and every single occurrence of the string PRINT in the program will be changed to LPRINT.

Macro Keys

CAU's *Full Screen Text Editor* uses the 26 letter keys in Extended Command mode to insert Basic keywords into programs. The 26 are preprogrammed, from ABS(on the A key to STOP on the Z key. If you like, you can change the character string associated with any key, and use any letter or number combination up to six characters per key.

Renumbering Lines

All you need do to renumber the program is to enter N and two numbers, for the first line and the increment:

N100,5

will renumber the entire program with lines 100, 105, 110, etc. The big thing about this command is that when the editor renumbers the lines, it also changes all line number references within the program to reflect the new numbers.

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COMPUTERS

Loading

Loading the screen editor turned out to be a little different than what the manual specifies. Use this sequence (if you have a 48K TRS-80):

```
XEDIT48
BASIC
RUN"XEDIT/BAS"
LOAD "SAMPLE/BAS"
XEDIT
```

That fourth line loads a sample program provided on the tape for demonstrating all the editor's features.

The CAU *Full Screen Editor* is $29.95 for 16K, 32K, or 48K Model I/III/4, supplied on tape, with instructions for moving it to disk. (It is not available for Level I machines.) The editor on disk is an extra $5. Add $2 for shipping in the U.S. and Canada.

ZBasic 2.2 Compiler

Simutek Computer Products, which offers *CopyArt II*, a "word graphics data processor" that combines a word processor, graphics, math, sorting and mailmerge (June 1983, p. 304), also has a Basic compiler that may knock your socks off.

Try the following on your TRS-80:

```
100 FOR X=0 TO 127
110 FOR Y=0 TO 47
120 SET (X,Y)
130 NEXT Y: NEXT X
```

and see how long it takes to turn the graphics area from black to white. That is about 46 seconds on a Model III.

If you have previously loaded the ZBasic 2.2 compiler, you write the program in TRS-80 Basic as usual, then hit the Z, X, and C keys simultaneously. ZBasic compiles the program in machine language in a trice, then asks if you want to run the compiled version, save it, or return to Basic. Run it, and the screen turns white in a little less than two seconds.

Simutek advertises ZBasic 2.2 as "the world's fastest TRS-80 Basic compiler," for $89.95 on disk (with both 32K and 48K versions), $79.95 on tape (16K, 32K, and 48K versions on the same tape), $99.99 for both disk and tape, and $25 for the manual only.

For each memory size, there are versions (on the same disk or tape) with and without high precision math, which is accurate up to 62 places.

ZBasic is also advertised as "the only interactive Basic compiler for the TRS-80," meaning that your TRS-80 memory contains both the original Basic program and the compiled machine language version, and you can use either.

TRS-80 Strings, continued...

By the way, ZBasic was written by Andy Gariepy, whose brother Mike (president of Simutek) wrote *CopyArt II* with a special version of ZBasic.

Nearly a third of the 72-page manual consists of an annotated list of ZBasic keywords to let you know which are used in ZBasic and how they differ from TRS-80 Basic keywords, if at all. Most are exactly the same, but a few are new or different. Some have the same name as TRS-80 Basic functions, but do very different things.

Some ZBasic Functions

AUTO generates a musical sound, with tone, duration, and frequency parameters, for sound effects or music (in TRS-80 Basic, AUTO renumbers lines automatically).

CDBL performs a very fast search, looking for a particular byte among a specified number of bytes, starting at a given memory location and searching backwards. CINT is the same, but searches forwards.

CONT returns the video memory address of the screen at a given point expressed in graphics point coordinates.

DEFB specifies the integer format; all subsequent output statements, such as PRINT, will output the low byte of an integer in hex form. Thus DEFB:PRINT 255 will print FF on the screen.

DEFN is similar, outputting a signed number. DEFU outputs an unsigned number. DEFW outputs the integer as a hex word.

DEFDBL defines specified variables as strings, because ZBasic does all its floating point math in strings.

ERL moves a certain number of bytes starting at a given memory location to another memory location.

FIX performs the XOR function in memory and is a good way to invert the graphics screen, creating quick flashes for explosions or signs or whatever.

LOC returns the present record number.

LSET loads a string into a fielded buffer.

And there are many more. Not supported by ZBasic are ATN, COS, DEFUSR, DEFFN, EXP, INT, LIST, LOG, NEW, SAVE, SIN, and TAN.

The manual goes on to show how to use MERGE to insert machine language code into a ZBasic program, how the PRINT USING function has been made more versatile, how to relocate ZBasic programs, to any part of memory you choose, how to chain ZBasic programs, how to convert Basic programs so they will run in ZBasic (the main difference is the floating point math package and disk I/O,) and how to use the MISOSYS utility for appending or merging compiled programs and machine language programs from tape or disk. (That last one is for 180-proof computerniks.)

ZBasic is fast and good. Programs run from 10 to 100 times as fast as in TRS-80 Basic. Compilation time is typically two seconds for a 4K program.

No royalties are imposed on registered owners who sell (or buy) programs created with ZBasic; they need only give credit to Simutek (with a copyright notice) in the program and in the documentation.

For the fastest Basic you can imagine, try Simutek's ZBasic 2.2 on your Model I, III, or 4. It works with almost any DOS, and could become your most useful program.

Acorn Software

Several programs from Acorn Software Products have been reviewed here, including *Astroball, Lost Colony,* and *Money Manager* (Nov. 1982, p. 310).

However, not much has been heard from Acorn recently, because the company that owned Acorn, The Program Store, in Washington, DC, decided to focus on retailing and get out of publishing.

Acorn was bought this last July by Banbury Books, of Wayne, PA. Banbury publishes mass market books and has just started publishing computer books, such as James Kelly's on the IBM PC.

Banbury will offer some of the previous Acorn programs in repackaged form, and new ones will be added. They will be available in some computer stores, or directly from Acorn.

One program that Acorn offered before, and which will be advertised under the new aegis, is *Family Tree,* written in Basic for a 32K TRS-80 Model I/III/4; $29.95 on disk. If it isn't available at your local computer store, you can get it for an additional $2 for shipping and handling, from Acorn Software Products.

Family Tree

Family Tree is a genealogical program that lets you set up a database to hold information about each ancestor, including name, date and place of birth, marriage and death data, a comment line, and a number to indicate the person's generation in your family tree.

The information can be printed out in a variety of formats and combinations; you are not held to the standard forms used for genealogies.

The program accommodates direct ancestors only: parents, grandparents, great grandparents, etc., to the limits of your family history, or your computer memory. According to the extensive 20-page manual, "Uncles, cousins, nieces, and second spouses are peripheral to your family tree. However, you may elect to use the 'comment' area of your ancestor records to include siblings."

Running Family Tree

The *Family Tree* program includes 20 sample records and is set up to show you, through examples, how the program works and how the various records are constructed. When you are ready, you enter your own records in place of the samples.

The first display shows 20 last names and says there is

SPACE FOR ABOUT 224 MORE

The next display is a menu offering a dozen options regarding the first of the 20 family names, which in this case is Smith:

```
THE SMITH FAMILY TREE
----------------------------
?
1 - SEACH BY SURNAME
2 -    "    "  GIVEN NAME(S)
3 -    "    "  YEAR OF BIRTH
4 -    "    "  PLACE OF BIRTH
5 -    "    "  YEAR OF MARRIAGE
6 -    "    "  PLACE OF MARRIAGE
7 -    "    "  YEAR OF DEATH
8 -    "    "  PLACE OF DEATH
9 -    "    "  COMMENT
10 - ANCESTRAL CHART
11 - PEDIGREE
12 - INDIVIDUAL RECORD(S)
0 -  END SESSION
```

You can search the Smith tree in nine ways: by surname, given name(s), year or place of birth or death, year or place of marriage, or by comment. Option 10 displays a three-generation chart, based on somebody you select. Option 11 displays a pedigree, which shows a direct line of descent from any ancestor you select to the subject of your genealogy. Option 12 allows you to search your records one by one.

After you have experimented with the sample database and become familiar with the various options, you can start entering your own records, using DATA statements to replace the samples.

There are some limitations, naturally, because of the size to which a family tree can grow. Comment fields are limited to 25 characters. Dates are year only.

On the other hand, some latitude has been built into the search mode. You can search for a first name with only part of it. Thus if you want the record of JOHN PETER, you can retrieve it with J, JO, JOHN, JOHN P, JOHN PETER, PETER, P, or just E (because there are E's in Peter). You can search for a date by the exact year (1892), a decade (189), a century (18). And if you want to list (or print) all your records, ask for the millennium (1).

Once you have started a search, you can refine it at any time. If you ask for all ancestors born in England, and several turn up, you can then ask for only those born in the 18th century to be displayed.

Once you have all the family tree information stored, you can search it in many ways, and then display or print out a variety of pedigrees and three-generation charts.

Migration Map

A novel feature of *Family Tree* is the migration map. In the pedigree option, you are asked if you want to see an outline map of the United States to show the movement of a particular family line across (or around) the country, generation by generation.

If you ask to see it, the computer draws the map and plots your ancestors by generation number in the state locations in which they were born. Foreign-born ancestors are identified as "born abroad."

Although of limited use to those who want to keep track of a complete genealogy, *Family Tree* can be recommended to those who prefer to keep to direct ancestral lines, and to those who would like to computerize the basic outlines of their complete genealogies.

Short Program #45:
Random-Number Series

From Port Tobacco, MD, Frederick P. Burggraf writes, "I thought I might pass on an idea I have incorporated in a number of my programs, and which might be of interest to your readers.

"What do you do if you want to generate a series of random numbers in a certain range, so that no number is repeated? For some time, I used the approach in Listing 1.

"That program will produce and print a series of numbers 1-30 with no repeats. Sample times for this process range from 12 seconds to 33 seconds. Clearly, this is too long for many applications. If card-shuffling was going on in a game program, it might take minutes for a 1-52 series to be generated.

"My alternative program is printed in Listing 2. The average time for this program to produce and print the 1-30 series is 2.8 seconds, with very little variation in the sample times.

"In line 40, R1 will point to the beginning of one number in the string. In line 50, DU$ stores a two-character number representation. Line 60 removes the number from the string and reconcatenates. Line 70 stores the value in the array.

"This program can be very useful when the range is specifed by an INPUT statement or when counters have kept track of input from tape or disk. A few lines must be added in such cases, to allow NU$ to be built. If N items have been read in from a file, the lines in Listing 3 will generate the NU$ upon which the program above can act.

```
10 DIM CP(30)
20 N=RND(30): CP(1)=N
30 PRINT CP(1);
40 FOR X=2 TO 30
50    CP(X)=RND(30)
60    FOR Y=1 TO X-1
70       IF CP(Y)=CP(X)
         THEN 50 ELSE NEXT Y
80    PRINT CP(X);
90 NEXT X
```

Listing 1.

```
10 CLEAR 172
20 NU$="0102030405060708091011121314151
   61718192021222324252627282930"
25 DIM CP(30)
30 FOR I=30 TO 1 STEP -1
40    R=RND(I): R1=R+(R-1)
50    DU$=MID$(NU$,R1,2)
60    NU$=LEFT$(NU$,R1-1)+RIGHT$(NU$,I*2-(2*R))
70    CP(I)=VAL(DU$)
80    PRINT CP(I);
90 NEXT I
```

Listing 2.

```
14 FOR X=1 TO N
16    DS$=MID$(STR$(X),2,2):
      IF LEN(DS$)=1
      THEN DS$="0"+DS$
18    NU$=NU$+DS$
20 NEXT X
```

Listing 3.

"Now, by simply merging this into the program, and changing 30 to N in lines 25 and 30, the program will function in a variety of situations where items need to be randomized.

"The program can also be modified to handle larger sequences. The string in line 20 must, of course, be extended to the desired length, and more string space must be CLEARed in line 10. With each additional number added to the string, six more bytes must be set aside. Thus, for a series of 1-52, the total number of bytes to be CLEARed is:

172 (enough for 1-30)
132 (6 bytes × (52-30))
304 bytes

"The DIM statement in line 25 must also reflect the higher series amount, and the upper number in for FOR . . . NEXT loop of line 30 must take on this new high value."

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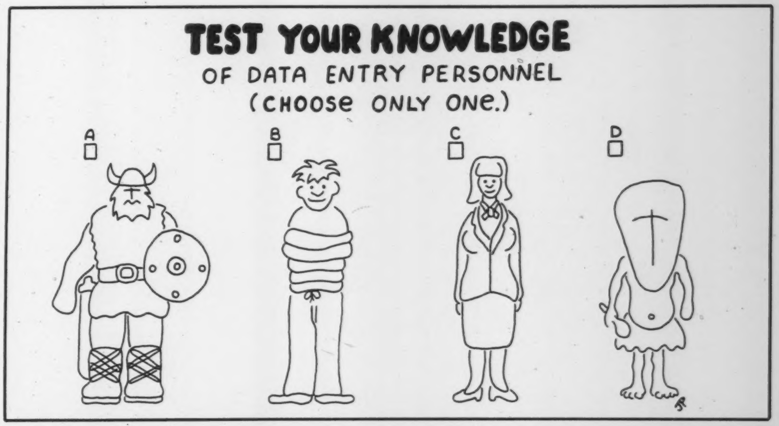

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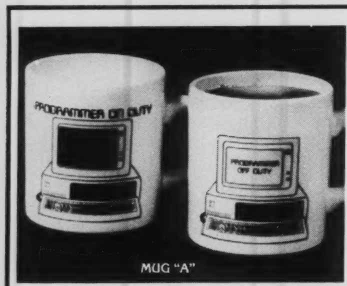

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Book Reviews

Introduction to Basic Programming, by Gary B. Shelly and Thomas J. Cashman. Anaheim Publishing Co., 2632 Saturn St., Brea, CA 92621. 439 pages, paperback $14.95. 1982.

This is probably the most colorful textbook on Basic: all 500 illustrations, though only a few program lines, are in bright colors.

The problem-oriented approach uses sample programs, each completely coded, "to show the proper way to design and code ... using the Basic language."

The first program is a long one, although half the lines are REMs, and the program is explained section by section. It prints a telephone directory, using READ/DATA, IF/THEN, PRINT, GOTO, and strings—a rather strong start.

The impersonal writing isn't quite up to the imaginative level of the artwork. On the other hand, it is thorough and usually quite clear and should be fine for a bright solo reader or for classroom use.

The Computer Image: Applications of Computer Graphics, by Donald Greenberg et al. Addison-Wesley Publishing Co., Reading, MA. 128 pages, hardcover $27.95. 1982.

This handsome book presents an instructive overview, then examines seven applications of computer graphics, with 38 color pages of examples of computer art, animated films, synthetic landscapes, molecule models, computer-aided design, remote sensing, and astronomy.

A chapter on color discusses its importance in graphics, followed by a chapter on computer-aided business graphics. The last chapter, Polaroid Instant Photography in the Computer Graphics Camera, acknowledges Polaroid's contribution to the state of the art, and is an obligatory bow to the sponsor.

This isn't a textbook: the 38 pages of examples contain no text beyond brief titles and attributions. It is more of a coffee table book, to be dipped into for pleasure. It is a time capsule, defining and capturing the state of the art of computer graphics at a particular instant.

A Guide For Software Entrepreneurs, by A.L. Frank. Prentice-Hall Inc., Englewood Cliffs, NJ. 202 pages, hardcover $29. 1982.

The theme of this book is to minimize the risks and maximize the rewards, but it isn't published in paperback; after all, $29 is little enough for a road map to success.

The 16 chapters discuss what a software entrepreneur is, how to begin a business, business entities, beginning detailed planning, product definition, system specifications, implementation, testing, marketing, sales planning, presales planning, sales, sales management, support, follow-on business, and The Rewards. Appendixes cover venture capital, legal protection of software, business fundamentals, how to present a seminar, and how a large software company (Informatics) looks at the software entrepreneur.

Stephen Gray

The book uses case studies to illustrate principles. Its structured yet informal approach provides simple rules based on the experiences of many successful software entrepreneurs and can be recommended to those who wish to join their ranks.

The TRS-80 Model III User's Guide, by Tony Bove and Leroy Finkel. John Wiley & Sons, Inc., New York. 262 pages, paperback $12.95. 1983.

Combining basic operations, advanced operations, and applications information, this nontechnical hands-on guide is for a 32K Model III with at least one disk drive.

The first eight chapters amplify the Radio Shack manuals, with enough added detail to be of interest to those beginners who find the Radio Shack manual too brief. However, it doesn't replace the Model III manuals, since not everything in them is explained here.

The book does not teach programming, for which the authors recommend Wiley books written by various friends and cohorts.

The last four chapters are of greater interest, if you are interested in *Scripsit*, *VisiCalc*, *Versa-File*, or *Videotex*, each of which gets two dozen pages.

For many beginners, this provides a friendly introduction to the Model III, with easy examples, written in a simple and very readable style.

Educational Software Directory: A Subject Guide to Microcomputer Software, by Marilyn J. Chartrand and Constance D. Williams. Libraries Unlimited, Box 263, Littleton, CO 80160. 292 pages, paperback $22.50. 1982.

Here is information on over 900 software packages for grades K-12. The 236-page core lists software by title within a dozen broad categories, from basic living skills to foreign languages.

Each entry includes the name of the package, publisher, grade level, format, hardware requirements, language, price, and an annotation, often lengthy.

The directory also lists publishers and distributors, and describes the company's products and preview policies. An annotated bibliography of sources helps implement computer-aided instruction; and there are indexes by subject and title. The programs listed are mainly for the Apple, Atari, PET, and TRS-80.

A major drawback: the annotations describe only how the programs work. All the information came from publisher and distributor literature, reviews, telephone calls, and so on: "No software has been examined by the compilers."

TRS-80 Model III Assembly Language, by Hubert S. Howe Jr. Prentice-Hall Inc., Englewood Cliffs, NJ. 351 pages, paperback $16.95. 1983.

In this revision of the author's 1981 book from the same

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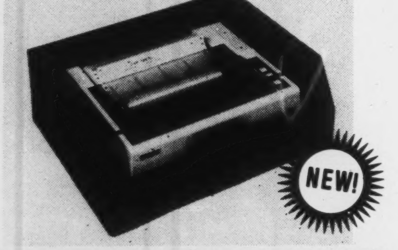

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Book Reviews, continued...

publisher, "TRS-80 Assembly Language," the first part, Basic Concepts, has been updated with chapters on the Model III ROM and RAM. The second part, Practical Programming, is about the same, but adds chapters on RS-232C and TRSDOS.

The revision includes a third, new part, on a monitor/debugger program, with a 65-page listing. The monitor is also available on disk for $22.95.

Parts I and II have the same good and bad points as in the first book. Although the back cover says "even beginners can learn basic concepts and how to write assembly language programs ... easily and quickly," it is still more of a reference book for those with some programming experience, who wouldn't feel overwhelmed by a summary, on page 16, of all ten Z80 addressing modes.

The part on Practical Programming is good, but if it explained the programs in more detail, and if Part I were better, longer and much more detailed, the book might begin to live up to the back-cover claims.

How to Buy a Word Processor, by Steven Manus and Michael Scriven. Alfred Publishing Co., Box 5964, 15335 Morrison St., Sherman Oaks, CA 91413. 62 pages, paperback $2.95. 1982.
How To Use VisiCalc/SuperCalc, by Carlton Shrum. Alfred Publishing Co. 48 pages, paperback $2.95. 1982.
Understanding APL, by Susan M. Bryson. Alfred Publishing Co. 45 pages, paperback $2.95. 1982.
Understanding Atari Graphics, by Michael Boom. Alfred Publishing Co. 50 pages, paperback $2.95. 1982.
Understanding Data Base Management, by Michael J. Freiling. Alfred Publishing Co. 63 pages, paperback $2.95. 1982.
Understanding LISP, by Paul Y. Gloess. Alfred Publishing Co. 64 pages, paperback $2.95. 1982.

These six tall, slim paperbacks, along with the other six reviewed (or soon to be reviewed) in these pages, make up the Alfred Handy Guide Series to Computers. (Other Alfred series are on cooking, health, music, and photography.)

All twelve back covers say these guides "tell you what you need to know quickly and easily—without a lot of reading!" Some may tell you more than you want to know, but for $2.95, you can't go far wrong.

The word processor guide is subtitled "Electronic Typewriters, Personal Computers, and Dedicated Systems" and provides a fast but good and thorough look at all three. The five sections look at What Are Word Processors? (Do you need one? What is available?); What Will Word Processors Do? (Levels of performance, checklist of functions and features); The Components (ergonomics, input, display, output, CPU, memory and storage, software, architecture); and The Costs and Savings (costs, savings, financing, buying used equipment); Comparing and Evaluating Systems (price, capabilities, convenience, reliability, support, reputation, buyer's comparison charts).

This is one of the best in the series, packing a lot of helpful information into only five dozen pages, with many photos and charts. The comparison charts are worth several times the price of the guide.

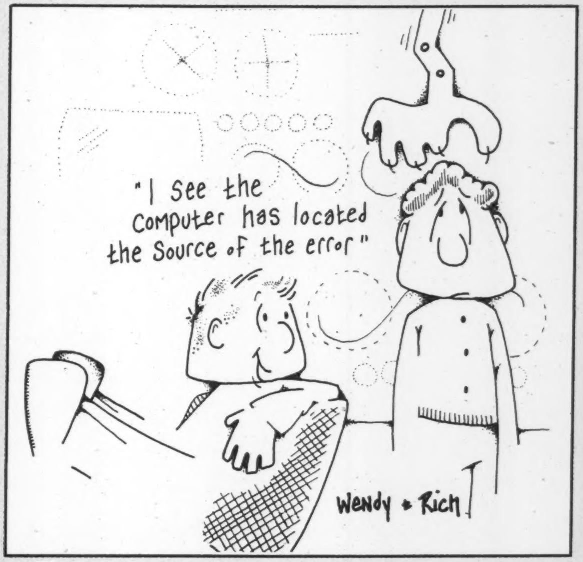
The *VisiCalc/SuperCalc* guide provides a taste of what the major electronic spreadsheet and one of its clones are like. The six chapters are: Introduction; The Spreadsheet on the Screen; A Sample Spreadsheet; Entering Information; Saving, Printing, and Reloading the Spreadsheet; Other Commands. Appendixes compare *VisiCalc* (from VisiCorp) with *SuperCalc* (from Sorcim), and provide a list of three dozen similar programs. The writing is somewhat formal for a short guide, and the graphics could be better, but the basic information is all here.

The APL guide is an excellent introduction that moves quickly from one basic function to another, with emphasis on simple examples and a very clearly written text. After demonstrating two dozen functions, the guide moves into areas such as workspaces, function definition, function editing, local versus global variables, and types of functions, to round out the presentation. Two appendixes provide scalar dyadic functions and five "other interesting APL primitives" with examples.

The Atari Graphics guide is said to help you "learn to create beautiful and practical graphics with easy to follow instructions for models 400 and 800." Although there aren't many graphics examples, there are eight programs: five long ones that demonstrate the display modes, draw a V, show the GTIA modes, rotate colors to create the illusion of motion, and create a color spectrum; and three short ones that create a 3D sinewave, etc. After looking at basic concepts and terms, the longest chapter is on graphics commands, followed by a chapter on the GTIA video display chip (installed on most Atari computers after January 1982, and providing three new graphics modes), and half a dozen Tips And Tricks. If you just want an idea of Atari 400/800 graphics, this is a pretty good source.

The database guide, subtitled "An Easy Overview of Today's Most Important Technology," is a rather formal approach to what could have been made much easier; it is several levels above the rest of the series. The idea of using an automobile manufacturer to illustrate a DBMS is fine, but the author uses phrases such as "analyzing the static semantics of an application" in what reads like a graduate school textbook. If that doesn't faze you, then perhaps the eight Bachman diagrams will. This then is a fairly high-level discussion, with chapters on (1) The Database System, (2) The Relational Model: A Data-Level Model, (3) Normalization and Schema Design, (4) The File-Level Models: Hierarchical and Network, and (5) Other Considerations.

The Lisp guide is subtitled "A Concise Introduction to the Language of Artificial Intelligence," and may be hard going unless you have a very good knowledge of at least one other high-level language, preferably APL or some such. Otherwise you may be discombobulated by the first page of the first chapter, which has sentences such as "Lisp ... programs are immediately executable without preprocessing by the so-called Lisp interpreter." If you have the right background, you will find that this guide is quite informative and packs a great deal about Lisp into 64 pages. It is very well written and wastes no time. END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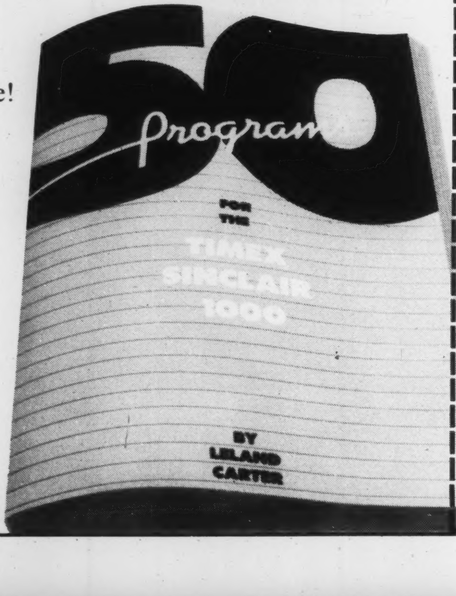

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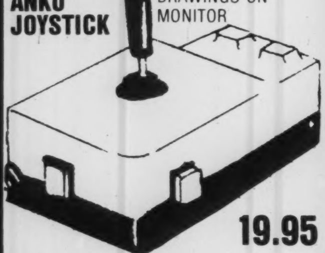

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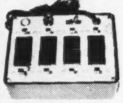

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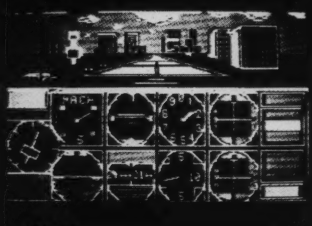

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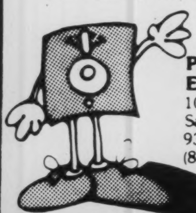

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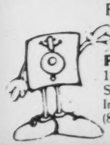

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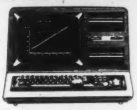

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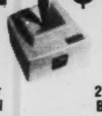

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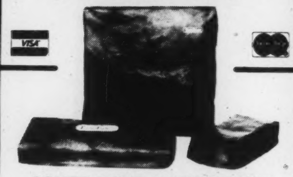

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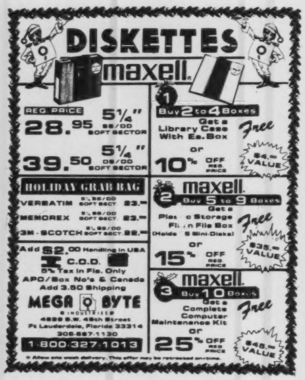

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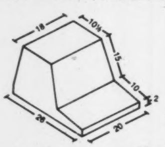

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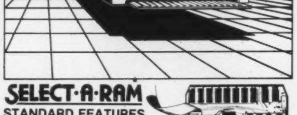

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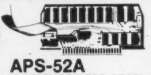

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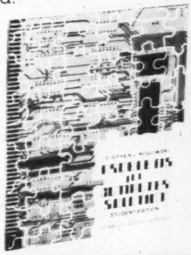

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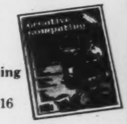

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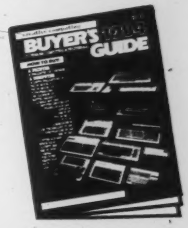

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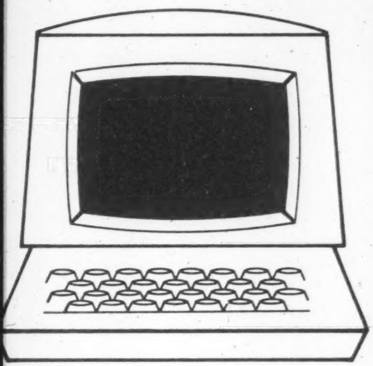

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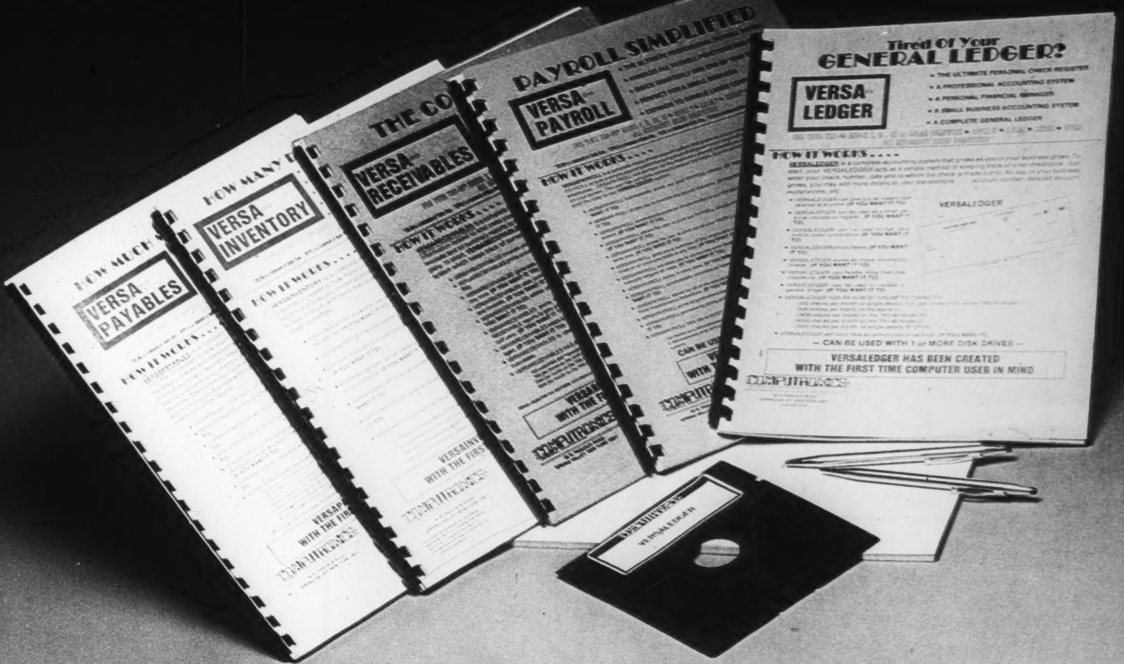

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- prints tractor-feed checks,
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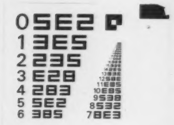
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